Road Design Manual Handbook
Chapters 5 and 8

PREFACE

The objective of this manual is to convey to each student the information necessary to accurately read and interpret the Road Design Manual Chapters 5, 6, and 8. This course is a supplement to the *Highway Plan Reading Volumes 1 and 2* training manuals.

The design of this manual takes into account the contract personnel whose duties may involve the design of highway plans.

You should have a copy of the entire Road Design Manual available when taking this course for reference.

This is a self-paced instructional study course with information presented in clear, easy to read topics, where each topic adds to the previous one. This method instructs by giving relatively small pieces of information followed by a series of questions.

Writing the answers in the spaces provided, and then comparing them to the answer key not only produces an excellent set of review notes, it reinforces the material, enabling students to retain it for a longer period.

Students are encouraged to immediately correct any mistakes, then, reread the material until they understand it. Additional review questions at the end of each chapter help students assess their understanding of the material.

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CHAPTER 8 ROADWAY PLAN PREPARATION

INTRODUCTION

1.1 Purpose

The *Roadway Design Procedures and Details* M*anual* has been created by the Road Design Section of the Louisiana Department of Transportation and Development (DOTD) to provide a convenient guide of the acceptable policies and procedures used for the development of roadway construction plans for DOTD. It is intended to promote consistency, where possible, between all individuals involved in the roadway design and plan preparation process.

This supplement to the Highway Plan Reading course is intended to introduce Chapters 5, 6 and 8 of the *Roadway Design Procedures and Details Manual* to aid consultants or others responsible for providing professional services to the Department. It may also be used as a guide for local public agencies on matters related to within their jurisdiction.

1.2 Format and Revisions

The *Roadway Design Procedures and Details Manual* will be periodically updated and entire chapters re-issued. The latest issue date of each chapter is shown at the bottom of each page.

1.3 Definitions of Commonly Used Terms

Throughout the *Roadway Design Procedures and Details Manual* , acronyms and abbreviations are used to increase readability. Also, various terms are used that need to be defined. As a quick reference, the definition of these acronyms, abbreviations, and terms are listed below:

- **DOTD** – Louisiana Department of Transportation and Development
- **The Department** - DOTD
- **FHWA** – Federal Highway Administration
- **PoDI** – Project of Division Interest
- **AASHTO** – American Association of State Highway and Transportation Officials
- **EDSM** – Engineering Directives and Standards Manual

- **MUTCD** – Manual on Uniform Traffic Control Devices
- **FAA** – Federal Aviation Administration
- **U.S.G.S.** – United States Geological Survey
- **LPA** – Local Public Agency
- **Letting** – Opening of sealed bids from prospective contractors
- **Shall/Will** – The use of "shall" and "will" designate mandatory conditions, and the designer will make every practical effort to follow the criteria. If it is impractical to follow these criteria, a design exception will need to be approved by the Chief Engineer.
- **Should** – "Should" is used as an advisory condition. It is recommended, not mandated, that the designer follow the criteria. For situations where it is impractical to follow these criteria, authorization will need to be obtained from the Road Design Engineer Administrator.
- **May** – The use of "may" indicates a permissive condition. The designer should make reasonable efforts to follow the criteria. For situations where it is impractical to follow these criteria, engineering judgment should be used, and no DOTD authorization is necessary.

1.4 Other Reference Sources

The *Roadway Design Procedures and Details Manual* is a principal source of information providing need to be referenced to supplement this manual. The design and detailing information available in general guidance on the policies and procedures that should be followed in the roadway design and plan development process. However, it does not contain all the information required to fully develop highway projects for the Department. Therefore, other publications adopted by DOTD will these other sources is not reproduced here. However, as the design process is discussed within this manual, appropriate reference to other publications are mentioned to provide a link for ease of use.

A brief description of each publication needed to supplement this manual is given below. Copies of these publications can be obtained as outlined in the section tabbed as "References." The designer should verify that the current version of each publication is used.

Publications Developed by Other Agencies:

1. **A Policy on Geometric Design of Highways and Streets** – Also known as the Green Book, this guide was developed by the AASHTO Standing Committee on Highways. Guidance included in the Green Book is based on established practices and is supplemented by recent research. It is intended to form

a comprehensive reference manual for assistance in administrative, planning, and educational efforts pertaining to design formulation. The Green Book is the primary source of design criteria and guidelines for the Department.

2. **Roadside Design Guide** – The AASHTO Task Force for Roadside Safety developed this guide. It presents a synthesis of current information and operating practices related to roadside safety.

3. **Highway Capacity Manual (HCM)** – Published by the Transportation Research Board (TRB), this manual represents a collection of state-of-the-art techniques for estimating capacity and determining level of service for many transportation facilities and modes. These techniques have been developed and enhanced through funded research projects and through review of the research results by the TRB Committee on Highway Capacity and Quality of Service.

4. **Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)** – This manual has been developed by the National Committee on Uniform Traffic Control Devices and its successors and approved by FHWA as a National Standard. It sets forth the basic principles that govern the design and use of traffic control devices including signs, signals, markings and other devices.

5. **Code of Federal Regulations (CFR)** – This is a codification of the general and permanent rules published in the Federal Register by executive departments and agencies of the Federal Government. The CFR and the Federal Register must be used together to determine the latest revision of any given rule.

6. **Highway Safety Manual (HSM)** – This manual was developed by AASHTO and provides quantitative methods to develop a safer, more efficient roadway transportation system. The manual achieves this goal by providing information and tools in a useful format in order to make the best decisions to reduce the number and severity of crashes on our roadways. The HSM provides knowledge, techniques and methodologies to quantify the safety related effects of transportation decisions. By using the HSM, the frequency and severity of crashes can be quantified and that information can be integrated into roadway planning, design, operations and maintenance decisions.

7. **Designing Safer Roads: Practices for Resurfacing, Restoration and Rehabilitation (TRB Special Report 214)** – This publication provides guidelines for design criteria of 3R projects and was used to establish DOTD design guidelines for PRR projects.

8. **Guide for the Planning, Design and Operation of Pedestrian Facilities** – This AASHTO guide provides guidance on the planning, design and operation of pedestrian facilities along streets and highways. Specifically, the guide focuses on identifying effective measures for accommodating pedestrians on public rights-of-way.

9. **Guide for the Development of Bicycle Facilities** – This AASHTO guide provides information on how to accommodate bicycle travel and operations in most riding environments. It is intended to present sound guidelines that result in facilities that meet the needs of bicyclists and other highway users.

Publications Developed by the Department:

10. **Engineering Directives and Standards Manual (EDSM)** – The EDSM consolidates all DOTD directives containing policies, procedures, standards and guides relating to the administration of the Highway Program which impact the engineering functions of the Department. It is organized along functional lines, with a separate volume provided for each of the following areas:

- Volume I – General Policies
- Volume II – Design and Contracts
- Volume III – Construction
- Volume IV – Maintenance
- Volume V – Material Quality Control
- Volume VI – Traffic Operations

EDSM directives are signed by the DOTD Chief Engineer, and will be followed by the designer, unless exceptions are granted as described in Section 2.3 of the *Roadway Design Procedures and Details Manual* . While this manual attempts to create uniformity and consistency in design and plan development, the EDSM should be followed should any discrepancies inadvertently exist between this manual and the EDSM.

11. **Location and Survey Manual** – Prepared by the Location and Survey Section, this manual provides guidance for conducting and documenting location surveys and property surveys. It also provides guidance for preparing right-of-way maps.

12. **Hydraulics Manual** – The Hydraulics Manual was developed by the Hydraulics Section and is a comprehensive documentation of the Department's hydraulic design policies. It contains information on rural, urban, wetland, airport and bridge hydraulic design. A user's manual for hydraulic programs described in the manual is also available.

13. **Bridge Design Manual** – The Bridge Design Section has prepared this manual as a design policy guide and aid on structural analysis and details. It also establishes uniform construction details to be used by those performing work for the Department.

14. **Louisiana Standard Specifications for Roads and Bridges** – This document compiles the bidding and contractual requirements, provisions for construction items, and material specifications necessary to construct roads and bridges for the Department.

15. **Project Managers Manual** – The Project Managers Manual is an internal DOTD document that defines the roles and responsibilities of the project manager starting with Stage 0 and continuing through Stage 6.

16. **Project Delivery Manual** – The Project Delivery Manual defines the project delivery process starting with Stage 0 and continuing through Stage 6. It also defines the roles and responsibilities that apply to each stage.

17. **Construction Plans Quality Control/Quality Assurance Manual** – This document defines quality control/quality assurance and discusses how it is applies to the plan development process.

18. **LPA Manual** - The purpose of the Local Public Agency (LPA) Manual is to familiarize the public agencies with the programs that are available to them through the DOTD for local transportation and public works projects. It is also intended to help Louisiana's public agencies fulfill the requirements of planning, environmental clearance, design, right-of-way purchase, construction and maintenance of transportation facilities using state or federal funds.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. **AASHTO** stands for _____.

2. The _____ is a principal source of information providing general guidance on the policies and procedures that should be followed in the roadway design and plan development process.

3. _____ directives are signed by the DOTD Chief Engineer, and will be followed by the designer, unless exceptions are granted.

4. The _____compiles the bidding and contractual requirements, provisions for construction items, and material specifications necessary to construct roads and bridges for the Department.

CHAPTER 5

CROSS SECTION ELEMENTS

5.1 PAVEMENT TYPICAL SECTIONS

Roadway typical sections are developed for each different roadway type within the project. During the Pre-Design Conference, the actual typical section widths, slopes, and other geometric controls to be used will be determined as guided by the Design Standards. Page 4 of the Pre-Design Conference Memorandum will be reproduced to record design criteria for each roadway type. The Department has developed typical section detail sheets using the Design Standards. If used, details should be checked to make sure that they meet the specific Design Standards applicable to the project, including modifications discussed at the Pre-Design Conference.

5.1.1 Pavement Type Determination & Structural Design

EDSM II.2.1.11 and II.2.1.12 (See Appendix A – Chapter 5) discuss the steps required to determine the pavement type and structural design required for a project. This process is initiated within the Road Design Section by requesting that the District Administrator complete the Project Information Checklist. The completed checklist, traffic data, and a request for the subgrade soil survey are sent to the Pavement and Geotechnical Design Administrator, who is responsible for the preparation of the pavement structural design. When asphaltic concrete is specified for the pavement structure, the Pavement and Geotechnical Section will typically furnish the asphalt types. Additional information concerning asphaltic concrete types is provided in the Asphaltic Pavement Design and Specification Policy and Standards memorandum contained in the Highway Specifications Workbook.

5.1.2 Subgrade Considerations

The depth and type of treatment to the portion of subgrade directly below the base course will usually be as recommended by the Pavement and Geotechnical Design Administrator as a part of the pavement structural design, or as requested by the District during the Plan-in-Hand Inspection. Also, the condition of the existing ground should be observed during the Plan-in-Hand Inspection to determine if undercutting, mucking, lime treatment or some other type of treatment will be required prior to placing the new embankment. If treatment is required, the soil borings will provide information on the depth of treatment that is necessary.

5.1.3 Drainage of Pavement Section

The presence of water under and within the roadway pavement section is extremely detrimental to the structural capacity and life expectancy of the pavement. EDSM II.2.1.8 (See Appendix A – Chapter 5) provides guidance on the use of drainage layers and shoulder drainage systems that help remove trapped water. See Figure 5-1 for an example of a shoulder drain detail. To help prevent water from entering the pavement structure from beneath, the design high water elevation should be 2 ft. below the base course, and roadside ditches should be set a minimum of 2 ft. below the lowest part of the base course.

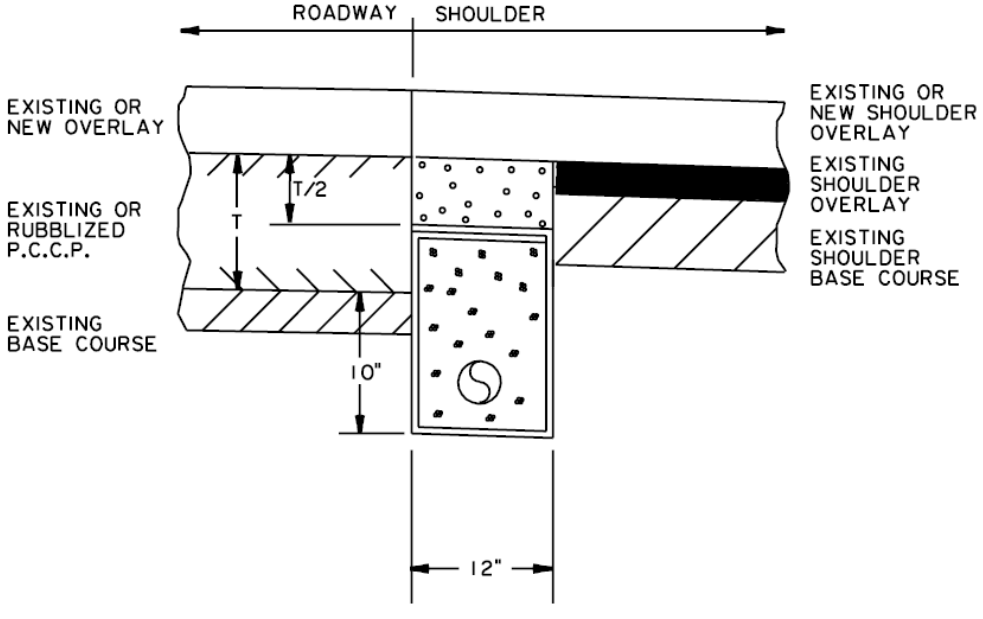


Figure 5-1: Detail of Shoulder Drain

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. During the _____, the actual typical section widths, slopes, and other geometric controls to be used will be determined as guided by the Design Standards.

2. _____ discuss the steps required to determine the pavement type and structural design required for a project.

3. When asphaltic concrete is specified for the pavement structure, the _____ _____will typically furnish the asphalt types.

4. The condition of the existing ground should be observed during the _____ to determine if undercutting, mucking, lime treatment or some other type of treatment will be required prior to placing the new embankment.

5. To help prevent water from entering the pavement structure from beneath, the design high water elevation should be _____ below the base course, and roadside ditches should be set a minimum of _____ below the lowest part of the base course.

5.2 TYPICAL SECTION GEOMETRICS

DOTD must follow AASHTO guidelines in the development of design standards. DOTD has produced Design Standards for freeways, arterials, collectors, and local roads and streets that meet these requirements. These standards delineate the approved geometric values to be used for both urban and rural roadways, at various design speeds and traffic volumes. Also shown are the values for lane widths, shoulder widths, side slopes, horizontal clearances (clear zones), right-of-way widths, and many others. These design values are shown in Section 2.2.

As noted in Section 5.1, the Pre-Design Conference Committee sets the approved values to be used. Should any value proposed be less than the Design Standards, a design exception will be required (see Section 2.3). EDSM I.1.1.5 (See Appendix A – Chapter 5) contains additional information relating to typical sections.

5.2.1 Travel Lanes

Travel lane widths are as noted in the Design Standards.

On higher-class highways, the pavement section is extended beyond the edge of travel lane to provide additional structural stability at the edge of travel lane. For all four-lane divided highways, the pavement section for the outside lane will extend three feet into the shoulder. On two-lane, two-way highways with traffic volumes greater than 2500 ADT and the percent trucks equal to or greater than 12 percent, the pavement section will extend 3 ft into the shoulders. The edge-line striping will be placed at the edge of the actual travel lane to delineate the correct lane width (see Figure 5-2).

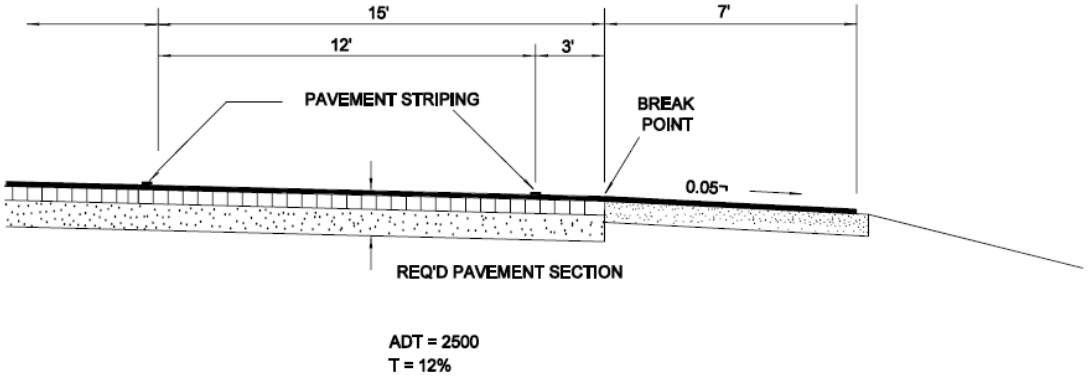


Figure 5-2: Pavement Width Extension

The standard pavement cross-slope adopted by DOTD for travel lanes is 2.5 percent (0.025 ft/ft) (see Figure 5-3(a)).

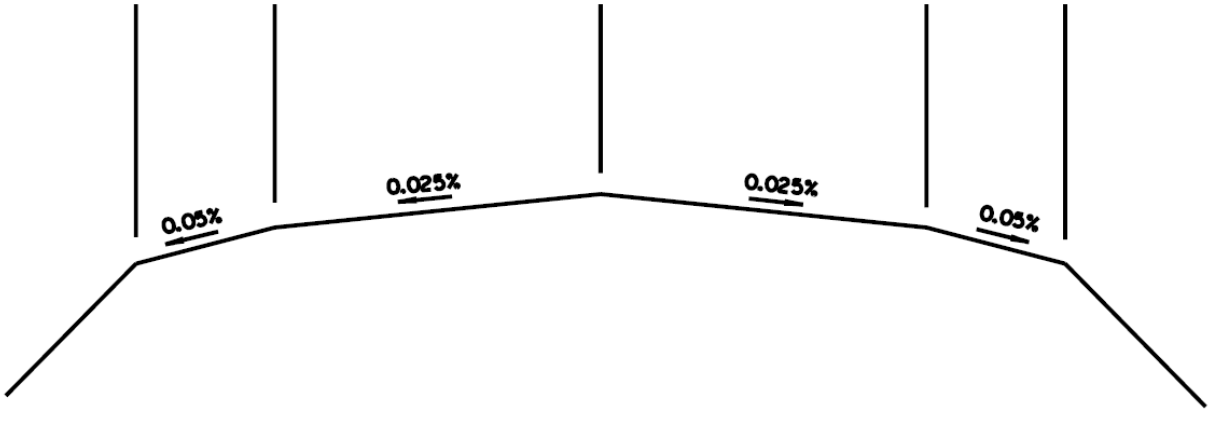


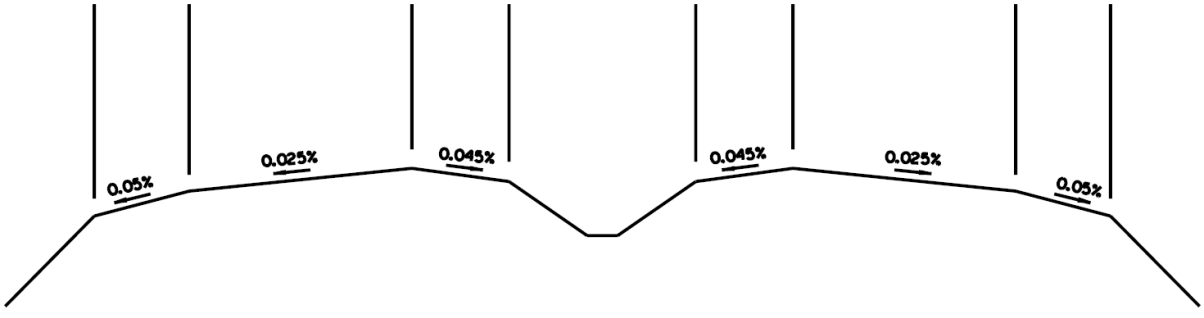
Figure 5-3 (a) 2: Lane Normal Crown

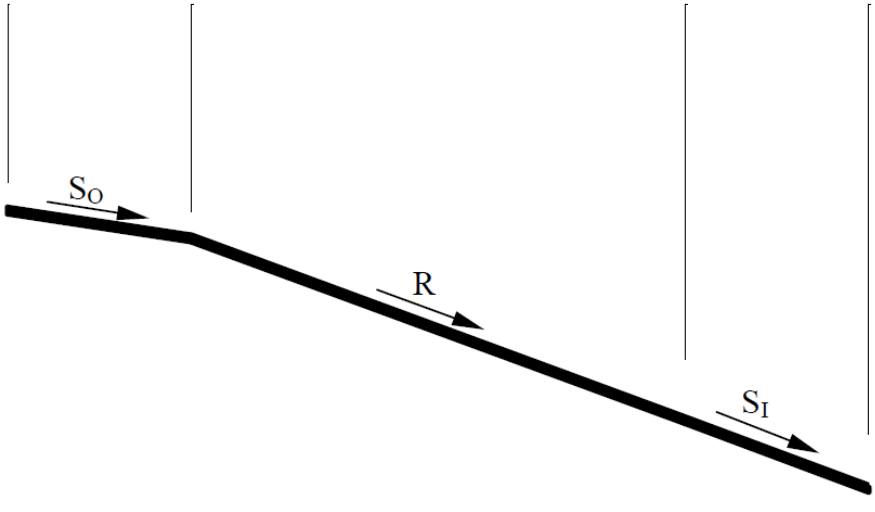
5.2.2 Shoulders

As shown in Figure 5-3(a), the standard shoulder cross-slope adopted by DOTD for two-lane, two-way tangent roadways is 5 percent (0.05 ft/ft). As noted in the opening paragraphs of Section 5.2, this can vary depending on project specifics. For instance, on some projects the shoulder cross-slope matches the roadway cross-slope. On four-lane divided highways, the cross-slope on the median shoulder in tangent sections is controlled by the cross-over crown restrictions in Section 5.3, thus restricting the value to 4.5 percent (0.045 ft/ft) (see Figure 5-3(b)). Similarly, the outside shoulder cross-slopes (the

convex side of the curve) on superelevated roadways will be controlled by the cross-over crown restrictions. As a result, the slope will depend on the superelevation rate (see Figure 5-4). On superelevated roadways, the inside shoulder will maintain its normal crown slope for superelevation rates equal to or less than the normal shoulder slope. For superelevation rates greater than the normal shoulder rate, the inside shoulder slope is the same as the superelevation rate. For additional discussion of superelevation, see Section 4.6 of the *Roadway Design Procedures and Details* M*anual*.

On all rural four-lane highways and most rural arterial and freeway highways, shoulder rumble strips are used to alert motorists that they have strayed from the travel lane (see Figure 5-5). The attendees of the Pre-Design Conference or Plan-in-Hand Inspection may request rumble strips on other highways with high traffic volumes. Raised pavement markers can be used in place of formed rumble strips on concrete shoulders where traffic must use the completed shoulders during construction.

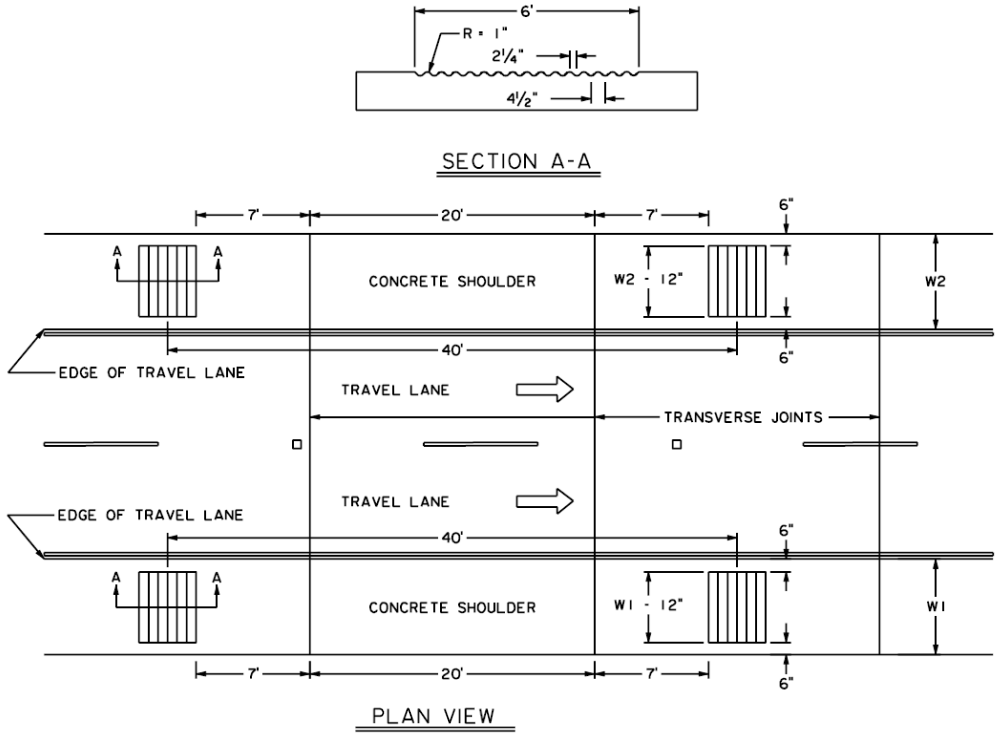




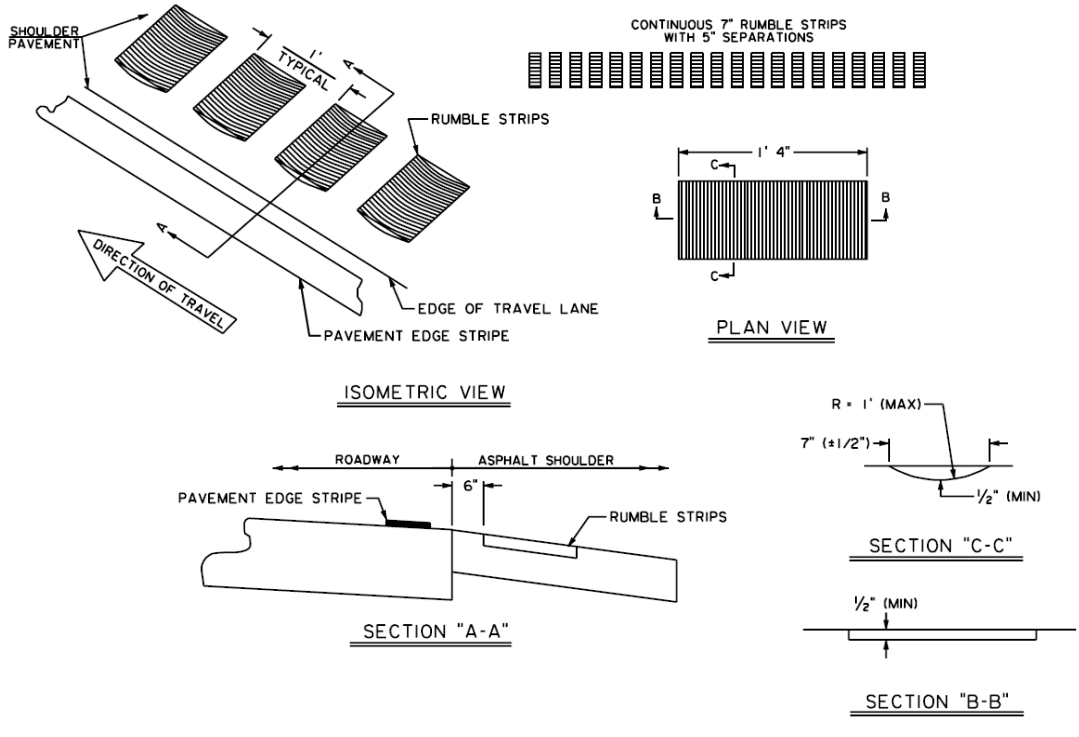
S_O = Outside Shoulder Slope
S_I = Inside Shoulder Slope
R = Roadway Superelevation Rate

Where $R \leq 5\%$, S_O = R-7% (Sloping Opposite Direction as Roadway); $S_I = 5\%$
Where $5\% < R \leq 9\%$, $S_O = +2\%$ (Sloping Same Direction as Roadway); $S_I = R$
Where $R > 9\%$, S_O = R-7% (Sloping Same Direction as Roadway); $S_I = R$

Figure 5-4: Shoulder Slopes in Superelevated Section



(a) Cast-in Rumble Strips on Concrete Shoulders



(b) Ground-in Rumble Strips on Asphalt Shoulders

Figure 5-5: Rumble Strip Details

5.2.3 Clear Zone Requirements

A roadside recovery area, or clear zone, should be provided beyond the edge of travel lane and should be free of any non-traversable hazard or fixed object. This requirement is known as the clear roadside concept. The clear zone should be as wide as practical to allow the majority of vehicles that leave the roadway to recover. The recommended width for the clear zone depends on the functional classification of the roadway. The Design Standards mentioned in Section 2.2 of the *Roadway Design Procedures and Details* M*anual* show the minimum width required to provide an adequate clear zone.

If signs, lighting, traffic signal poles and/or other appurtenances are required within the clear zone, breakaway posts must be considered. Due to their size, weight and location, breakaway traffic signal poles may pose more hazards to the road users than an impact and may not be an appropriate application. Guardrail or other barriers may be required in certain locations to shield formidable obstacles that may be present within the clear zone. Safety requirements at bridge ends are one example of these locations and are further discussed in Section 5.8. AASHTO gives direction on horizontal clearance requirements and detailed guidance on the selection, location and design of traffic barriers in the Roadside Design Guide.

5.2.4 Roadside Slopes

DOTD Design Standards specify the maximum (steepest) side slope that can be used on a project in order to meet clear zone requirements. Where a range of slopes is given, the Designer should strive to provide the flatter slope, but slopes as steep as the maximum are permitted. Use of side slopes steeper than the maximum will require design exceptions.

When 6:1 fore slopes are used on roadways where the fill height exceeds 8 ft, the 6:1 fore slope is typically carried through the clear zone only. From that point, a 4:1 fore slope is used until it intercepts the existing ground or proposed ditch grade. This will help to minimize embankment and right-of-way requirements.

Side slopes of lateral ditches and ditch blocks along with embankment slopes for driveways within the right-of-way limits should provide the same reasonable opportunity for vehicle recovery as the main roadway fore slopes. Therefore, side slopes of these sections shall not be steeper than the fore slopes of the main roadway. Desirably, 6:1 maximum slopes should be used for these sections, and 10:1 slopes are preferred for median ditch blocks on multi-lane highways.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. DOTD must follow AASHTO guidelines in the development of design standards. DOTD has produced _____ for freeways, arterials, collectors, and local roads and streets that meet these requirements.

2. Should any value proposed be less than the Design Standards, a _____ will be required.

3. On two-lane, two-way highways with traffic volumes greater than _____ ADT and the percent trucks equal to or greater than __ percent, the pavement section will extend ____ into the shoulders.

4. The standard pavement cross-slope adopted by DOTD for travel lanes is ____ percent.

5. On all rural four-lane highways and most rural arterial and freeway highways, _____ are used to alert motorists that they have strayed from the travel lane.

6. A roadside recovery area, or clear zone, should be provided beyond the edge of travel lane and should be free of any non-traversable hazard or fixed object. This requirement is known as the _____.

7. If signs, lighting, traffic signal poles and/or other appurtenances are required within the clear zone, _____ must be considered.

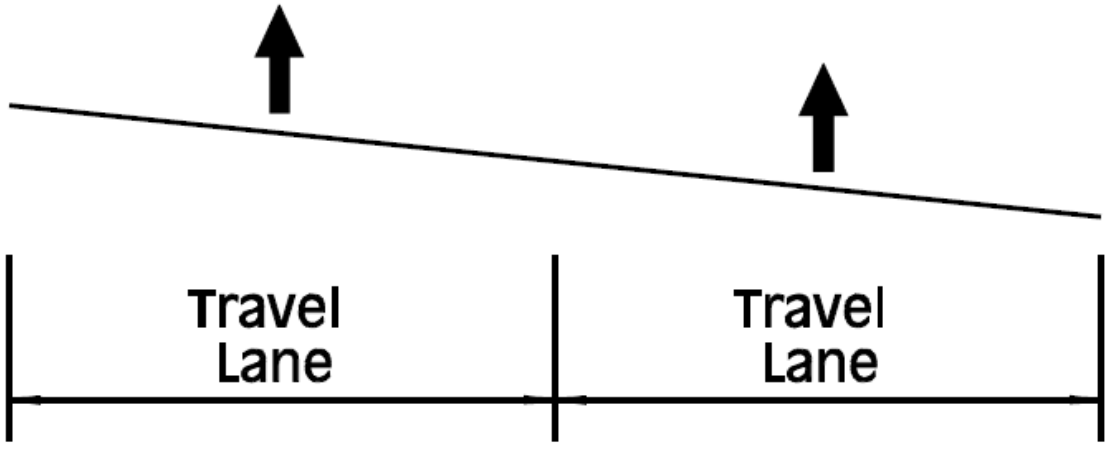
8. When 6:1 fore slopes are used on roadways where the fill height exceeds 8 ft, the ____ fore slope is typically carried through the clear zone only.

5.3 PAVEMENT CROWNS

1. One-way Tangent Crown: A one-way tangent crown slopes downward from left to right as viewed by the driver (see Figure 5-6). It is used for all roadways providing one-way traffic, except as noted in the following paragraphs.
2. Two-way Tangent Crown: A two-way tangent crown has a high point in the middle of the roadway and slopes downward toward both edges. It is used for all roadways providing two-way traffic (see Figure 5-7). For undivided multi-lane highways, the pavement is sloped downward and away from the median centerline, or from the left or right edge line of the median lane on a five-lane section.
3. Two-way Crown Converted to One-way Use: When an existing roadway with a two-way crown is converted from two-way to one-way use, the existing crown shape can remain.

4. Cross-over Crown Break: The cross-over crown break between main lanes is limited to an algebraic difference of 5 percent (0.05 ft/ft). This applies at the break point of a two-way crown. The algebraic difference between the main roadway cross-slope and shoulder cross-slope should not exceed 7 percent (0.07 ft/ft).

The maximum 5 percent break also applies to the difference between the roadway cross-slope and an intersecting roadway grade, where the intersecting road is at a stop condition. Where the intersection will be signalized, or may be signalized in the future, the intersection should be designed using a maximum break of 2.5 percent. Additional discussion of intersection design can be found in Chapter 6 of the *Roadway Design Procedures and Details* M*anual*.



ONE - WAY TANGENT CROWN

Figure 5-6

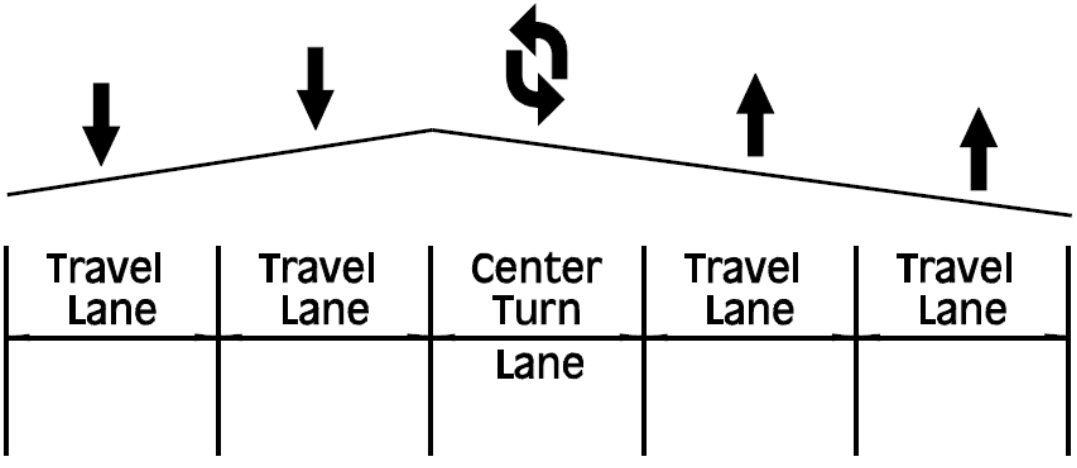
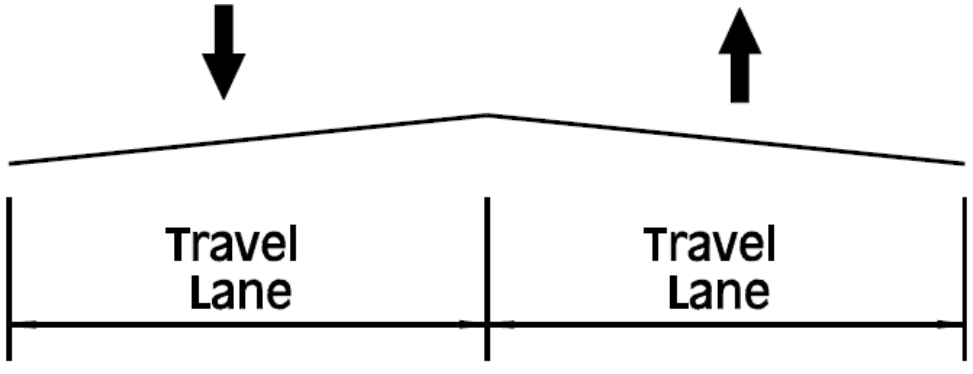


Figure 5-7



TWO - WAY TANGENT CROWN

Figure 5-7 (continued)

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. A _____ tangent crown has a high point in the middle of the roadway and slopes downward toward both edges.

2. The cross-over crown break between main lanes is limited to an algebraic difference of _____.

5.4 VERTICAL CLEARANCE

5.4.1 Roadway

Vertical clearances shown in the Design Standards apply to a structure over a roadway. These values include an additional six inches above the AASHTO recommended value to allow for future overlays. The point on the roadway where the critical clearance occurs will vary, depending on the cross-slope and longitudinal grade of both the under-passing and over-passing roadways.

When plans are prepared for overpass structures, the Bridge and Structural Design Section is responsible for ensuring that minimum clearances are provided. For reconstruction beneath an existing bridge that is to remain, the Designer is responsible for ensuring that minimum clearances are provided.

5.4.2 Railroads

The minimum vertical clearance required for a bridge structure over a railroad is 23 feet or as required by the owner of the railroad.

5.4.3 Waterways

The Bridge Design Section determines the vertical clearance required over waterways. This clearance is dependent on the type of navigation the waterway carries. Others involved in this determination are the Coast Guard, U.S. Army Corps of Engineers, waterway users, and port authorities.

5.4.4 Airways

FAA regulations require that an Airway-Highway Clearance Form be prepared whenever a project is constructed within two nautical miles of an airport. The Road Design Section has a manual that explains the requirements of this regulation. Included in the manual are layout maps of the airports that require this form. Sample formats of the form are also included, since the format varies depending on the proximity of the airport to the highway project.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. The minimum vertical clearance required for a bridge structure over a railroad is _____ or as required by the owner of the railroad.

2. The Bridge Design Section determines the _____ clearance required over waterways. This clearance is dependent on the type of navigation the waterway carries.

3. FAA regulations require that an _____ be prepared whenever a project is constructed within two nautical miles of an airport.

5.5 CURBS

The type and location of curbs affects driver behavior and the safety and utility of a highway. Curbs serve any or all of the following purposes:

- drainage control
- pavement edge delineation
- right-of-way reduction
- esthetics
- delineation of pedestrian walkways
- reduction of maintenance operations
- assistance in orderly roadside development

In the interest of safety, curbs should not be used on rural highways if the same objective can be attained by other means.

Curbs may be mountable or vertical, concrete or asphaltic, and may be constructed by a variety of methods. EDSM II.2.1.7 (See Appendix A – Chapter 5) outlines additional guidelines for the use of curb. Typical shapes and dimensions for various types of curbs, including curb and gutter, are shown in Figure 5-8 (See Appendix A – Chapter 5).

5.5.1 Location Relative to Travel Lanes, Guardrail, etc.

For a normal roadway section with curb, the curb is offset from the through travel lane as shown in Figure 5-8 (See Appendix A – Chapter 5). When used to delineate raised islands, like those commonly placed at intersections, the curb should be offset from the travel lane as discussed in Section 5.5.6. Additional discussion on the location of curbs is contained in Chapters IV and IX of the AASHTO Green Book.

The relationship of curb-to-guardrail is critical. If the curb is not located properly, the guardrail will not function as intended. Chapter 5 of the Roadside Design Guide discusses the location of curb with respect to the face of the guardrail.

5.5.2 Types

1. Mountable or Vertical: Curb shapes are generally classified as either mountable or vertical. The typical mountable curb has a flat sloping face and is one foot wide by four inches high. The typical vertical curb has a steep face and is six inches wide by six inches high.

   Generally, vertical curb is only used when sidewalks are provided and in the curb return of turnouts to intersecting streets. Also, if a municipality requests that provisions be made for future sidewalks, barrier curb should be used.

2. Concrete or Asphaltic: Portland cement concrete is used for most curbs. Asphaltic curbs are limited primarily to median curbs on overlay projects.

5.5.3 Method of Construction

1. Integral: For concrete pavements, integral curb is preferred to curb and gutter because of economy in initial construction and maintenance. With this method, the concrete curb is poured when the concrete slab for the roadway is still in a plastic state. This creates an integral bond between the roadway and the curb (see Figure 5-8 (a & b) (See Appendix A – Chapter 5). An alternate, and more popular, method of construction is to place dowel bars in the plastic concrete of the roadway slab, as shown in Figure 5-8(c through e) (See Appendix A – Chapter 5). Later, when the pavement has hardened, the curb is poured so that the dowel bars hold the curb firmly in place on the roadway. Although not truly
2. Curb and Gutter: Concrete curb and gutter, as shown in Figure 5-8(f through l) (See Appendix A – Chapter 5), is generally used with asphaltic concrete pavement. Under this method, both the curb and the gutter are poured together, but not at the same time as the roadway pavement. Widths vary from 1.5 ft to 2.5 ft, with 2 ft being the most common width for both mountable and vertical types as shown in Figure 5-8 (f through h) (See Appendix A – Chapter 5). Where curb and gutter is placed adjacent to concrete pavement on curved sections, dowel bars should be used to connect the curb and gutter to the adjacent pavement. This prevents separation of the curb and gutter from the edge of the pavement.
3. Plain: Plain concrete curb, as illustrated in Section H-H of Figure 5-9 (See Appendix A – Chapter 5), is generally used in small quantities adjacent to an existing pavement, driveway, or parking area. While this curb requires a relatively large amount of concrete for stability, it is usually preferred over curb and gutter (for small quantities) because of the savings in labor required for forming and finishing.
4. Extruded: This method is commonly used for combination curb and gutter and asphaltic curbs. Extruded curb is placed by machine with no forms required.

5.5.4 Curb Detail at Driveways

1. Mountable Curb: The standard four-inch high mountable curb is reduced to two-inches in height across the full width of the driveway, including radii or flares. Driveway details that illustrate the reduction in curb height are shown in Figures 5-9 and 5-10 (See Appendix A – Chapter 5). Persons applying for a permit to build a driveway after completion of the project have the option of connecting the driveway flush with the top of the existing curb or reconstructing the curb, as noted above.

2. Vertical Curb: When vertical curb is used, it is reduced in height at driveway locations by a method similar to that used for mountable curb.

3. Curbed Driveways: Driveways are curbed only for the conditions described below:

    a. Replacement of Existing: If the existing driveway is curbed, it will be replaced with a curbed driveway. For a single driveway that is curbed, both sides of the driveway will be curbed, using the curb shown by Section E-E in Figure 5-9 (See Appendix A – Chapter 5).

    b. Adjacent to Curbed Island: When a curbed island is used outside of the roadway, the opposite edges of the driveways shall also be curbed (see Figure 5-9) (See Appendix A – Chapter 5).

4. Curbed Islands: Curbed islands in conjunction with driveways are used only for the conditions described below.

    a. Replacement of Existing: An existing curbed island should be replaced as shown in Figure 5-9 (See Appendix A – Chapter 5).

    b. Service Stations: If a pump island at a service station is less than 10 ft from the right-of-way line, a curbed island must be placed with a line of barrier curb running along the right-of-way line as shown in Figure 5-9 (See Appendix A – Chapter 5). This is to prevent vehicles from being served on highway right-of-way.

c. Continuously Paved Area: If continuous pavement is located adjacent to the highway right-of-way where more than one driveway is required, an island should be placed between driveways to control access.

d. Access Control: Curbed islands may be placed in other areas as recommended by the Plan-in-Hand Party if it appears that access control will be a problem. For example, a curbed island could be placed to prevent vehicles from parking on the highway right-of-way.

5.5.5 Raised Median Noses

To prevent vehicles from breaking the curb in the nose of raised median, a monolithic section of curb and median pavement should be constructed. See Figure 5-11 for example details (See Appendix A – Chapter 5).

5.5.6 Curbed Islands

Curbed islands help control and direct the movement of traffic by reducing excess pavement areas. In urban locations, mountable curb is typically used in conjunction with striping to delineate the island. In rural locations where higher speeds are likely, islands are typically delineated with mountable curb as discussed in EDSM No. II.2.1.7 (See Appendix A – Chapter 5).

Figures 5-12 and 5-13 (See Appendix A – Chapter 5) show island design details for pavements with and without shoulders, respectively. The island size is typically as follows:

- Small – Area 50 to 100 square feet with sides in excess of 12 ft to 15 ft
- Large – Area in excess of 100 sq ft (used at isolated intersections on high-speed highways)

Curbs should be offset from the travel lane as shown in Figures 5-12 and 5-13 (See Appendix A – Chapter 5) and the noses rounded appropriately. Additional discussion is contained in Chapter IX of the AASHTO Green Book.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. Curbs can be used to:
   a. drainage control
   b. pavement edge delineation
   c. assistance in orderly roadside development

d. all of the above

2. _____ outlines additional guidelines for the use of curb.

3. If the curb is not located properly, the _____ will not function as intended.

4. Curb shapes are generally classified as either _____ or _____.

5. _____ curbs are limited primarily to median curbs on overlay projects.

6. Concrete curb and gutter is generally used with _____ pavement.

7. Curbed islands in conjunction with driveways are used only for :

a. Replacement of Existing
b. Service Stations
c. Continuously Paved Area
d. All of the above

8. _____ help control and direct the movement of traffic by reducing excess pavement areas.

5.6 SIDEWALKS

5.6.1 General

Requirements for construction of sidewalks are contained in EDSM II.2.1.10 (See Appendix A – Chapter 5). During the Pre-Design Conference, the need for sidewalks should be discussed with the District representative. If it appears that sidewalks are warranted, the District representative should discuss the requirements with local officials and obtain tentative agreement to the stipulations in the EDSM from the municipality. Notes concerning sidewalks will be included in the Pre-Design Conference Report and the sidewalks included in the preliminary plans.

The Designer will send a written request to the Contracts Management Section relaying the verbal agreement and requesting that a formal agreement be prepared as such. After the entity-state agreement is prepared, the Contracts Management Section will send it to the municipality for their

approval and agreement to the stipulations in the EDSM. If a signed agreement is not received, the sidewalks will be removed from the plans before the construction letting.

If a municipality requests that provisions be made for a future sidewalk, barrier curb should be used along the roadway. This request should be documented in the plans and project files.

5.6.2 Location

The Design Standards recommend that sidewalks be at least 4 ft wide. Sidewalks are normally offset 2 feet or more from the back of curb, with a grass berm separating the curb and walk. If a sidewalk is placed adjacent to the curb, it must be at least 6 ft wide and a barrier curb will be required (see Figure 5-14 for typical sidewalk locations). The city, or authority responsible for sidewalk maintenance (including the grass berm, if required), may choose a location and width greater than the minimum values, if they prefer.

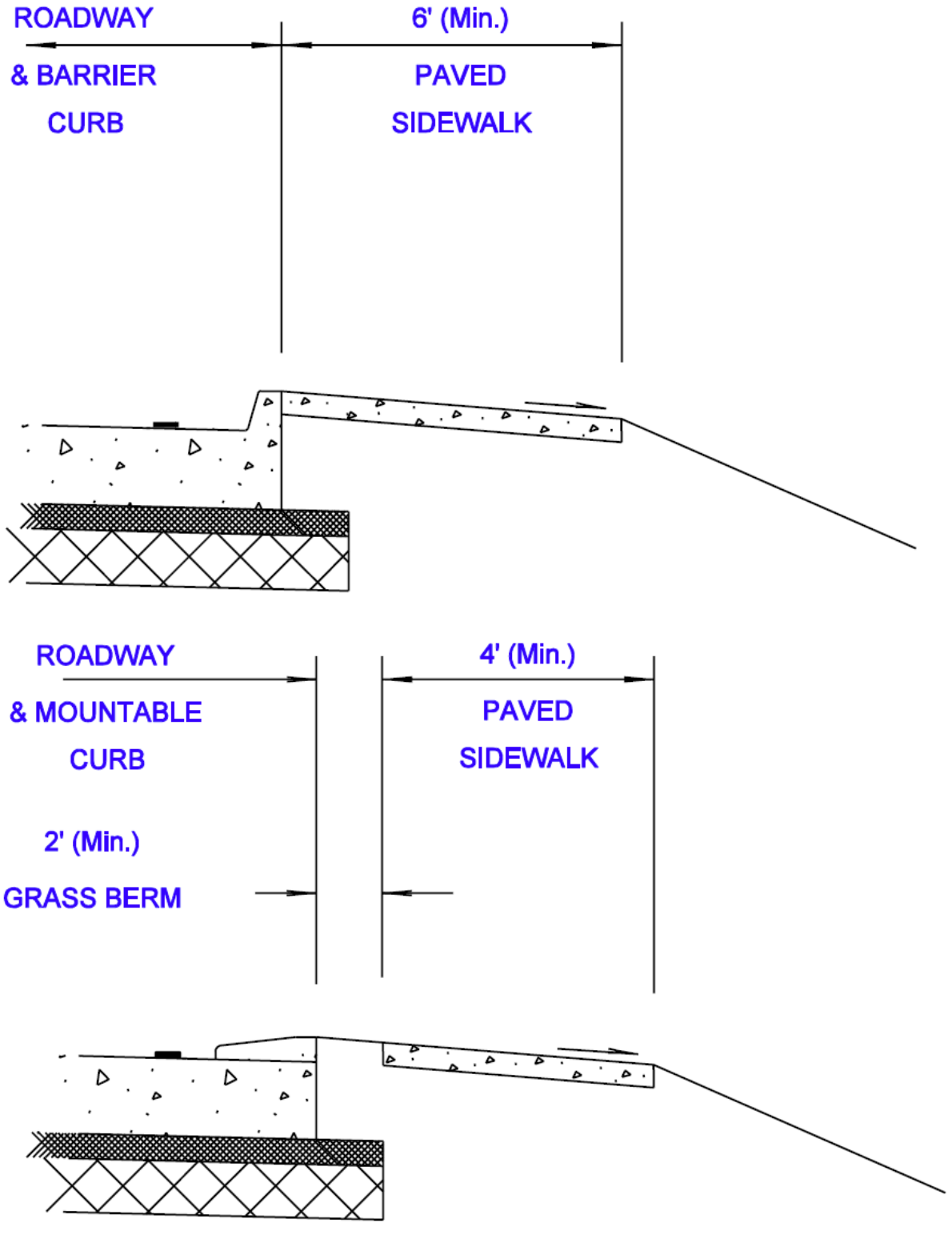


Figure 5-14: Typical Sidewalk Locations

5.6.3 Cross-slope

In accordance with the Americans with Disabilities Act (ADA), sidewalk cross-slopes will be no greater than 2.0 percent (positive or negative).

5.6.4 Handicap Ramps

In order to comply with the Americans with Disabilities Act (ADA), handicap ramps will be included on all projects that contain both sidewalks and curbs. See Standard Plan HR-01 for details.

5.6.5 Bridges

EDSM II.3.1.4 (See Appendix A – Chapter 5) provides guidance on the placement of sidewalks on bridges in urban areas. The preferred option for bridge configuration is shown in Section II.B.2.a of the EDSM, unless circumstances dictate otherwise.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. Requirements for construction of sidewalks are contained in _____.

2. If a municipality requests that provisions be made for a future sidewalk, _____ should be used along the roadway.

3. If a sidewalk is placed adjacent to the curb, it must be at least _____ wide and a barrier curb will be required

4. In order to comply with the Americans with Disabilities Act (ADA), handicap ramps will be included on all projects that contain both _____.

5. _____ provides guidance on the placement of sidewalks on bridges in urban areas.

5.7 BARRIERS

5.7.1 General

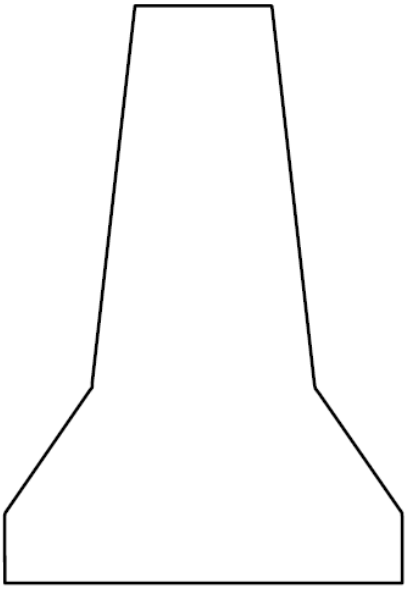
Chapters 5 and 6 of the AASHTO Roadside Design Guide provide details on the application and design of various barriers, including guardrail and concrete median barriers. Recommendations on the layout and type of barrier to be used are usually obtained from the Bridge Design Section when bridges are involved. All other applications are the responsibility of the Designer, but the Bridge and Structural Design Section will provide guidance as needed.

5.7.2 Guardrail

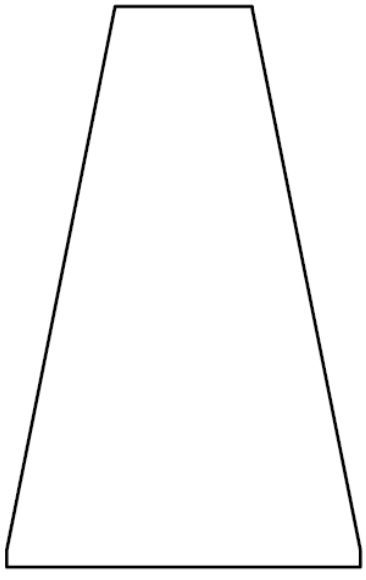
The types of guardrail normally specified are W-Beam and Thrie Beam. The actual construction details and uses are shown in various standard plans and in the project plans (see Standard Plans GR-200, GR-201, GR-202, GR-203A, and GR-203B).

5.7.3 Concrete Barrier Rail

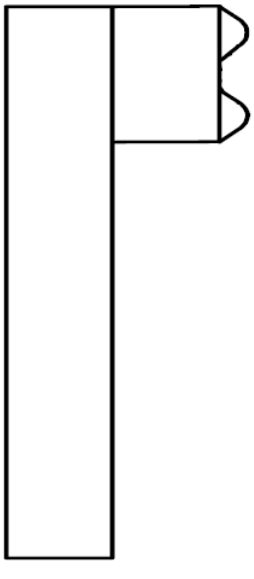
Concrete barriers are designated by the shape of the barrier face adjacent to traffic (G.M., New Jersey, F., Single Slope, Safety Shape, etc.) and will be detailed in the plans when required. Figure 5-15 shows typical barrier types. Details showing the construction requirements are available from the Bridge Design Section.



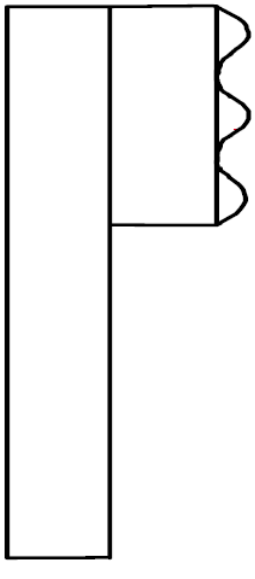
F-SHAPE
CONCRETE BARRIER



SAFETY-SHAPE
CONCRETE BARRIER



W-BEAM
GUARDRAIL



THRIE-BEAM
GUARDRAIL

Figure 5-15: Typical Concrete Barrier and guard Rail Shapes

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. Concrete barriers are designated by the shape of the barrier face adjacent to traffic and will be detailed in the _____when required.

5.8 EMBANKMENT WIDENING FOR GUARDRAIL AT BRIDGES

Guardrail is normally placed at the approach end of bridges to protect vehicles from the blunt end of the bridge railing. It provides a roadside barrier that transitions the rigid bridge railing to a more flexible, forgiving system for the length required in advance of the bridge end. In some instances, the guardrail also protects vehicles against obstacles behind the bridge rail or areas that do not meet clear zone requirements.

The roadway embankment should be widened at these locations with relatively flat slopes to allow the guardrail to be properly placed and function as designed. The slopes of embankment widening are typically 10:1 maximum, but occasionally are designed to match the shoulder slopes.

To reduce maintenance adjacent to the guardrail and guardrail posts, the embankment widening is usually paved. Typically, the asphaltic concrete pavement types and thicknesses used for the shoulder are extended through the widening section as shown in Figures 5-16 and 5-17 (See Appendix A – Chapter 5). Occasionally, the plan-in-hand party will recommend other types of pavement in lieu of the asphalt section.

Details of the embankment widening layout are placed in the plans, normally with the typical section sheets. The Bridge Design Manual and the guardrail standard plans contain additional information concerning the layout of the guardrail and embankment widening.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. _____ a roadside barrier that transitions the rigid bridge railing to a more flexible, forgiving system for the length required in advance of the bridge end.

2. The _____ and the _____ contain additional information concerning the layout of the guardrail and embankment widening.

5.9 MEDIANS

5.9.1 General

Medians are areas provided on divided roadways to separate opposing lanes of traffic and may be either depressed or raised. The median width is measured between the edges of the inside travel lanes. See Section 6.2.2 for a discussion of left turn lane design, and Section 6.6 for a discussion of median openings.

5.9.2 Rural

DOTD Design Standards contain the desirable depressed median widths for use on rural projects. The use of the desirable values must be weighed against the social, economic, and environmental impacts. Should constraints require a lesser value or require a raised median, a design exception will be required (see Section 2.3). Figure 5-18 (See Appendix A – Chapter 5) shows an example of a depressed median section for a rural roadway.

5.9.3 Urban

As shown in Figure 5-19 (See Appendix A – Chapter 5), a 14 ft. flush median is commonly used as a continuous left turn lane on urban arterials and collectors. The continuous left turn is used to:

- reduce travel time
- improve capacity
- reduce accident frequency (particularly rear-end accidents)
- facilitate maintenance of through traffic during construction or lane-closure of a through lane

If requested by the municipality and if proper median maintenance agreements are obtained, raised, grassed medians as shown in Figure 5-20 (See Appendix A – Chapter 5) may be used in special situations. Raised, grassed medians are used to regulate left turn movements, provide positive separation of opposing lanes of traffic, and, where properly maintained, provide a more esthetically pleasing roadway.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. Medians may be either _____ or _____.

2. A 14 ft. _____ median is commonly used as a continuous left turn lane on urban arterials and collectors.

3. A continuous left turn lane is used for.

   a. _____

   b. _____

   c. _____

4. Raised, grassed medians are used to:

   a. _____

   b. _____

   c. _____

5.10 FRONTAGE ROADS

5.10.1 General

Frontage roads provide numerous functions depending on the type of arterial they serve and the character of the surrounding area. They may be used to control access to the arterial, to accommodate adjoining property, and to maintain traffic circulation on each side of the arterial. Frontage roads segregate local traffic from the higher-speed through traffic and intercept driveways from residences and commercial establishments along the highway. Most existing frontage roads were built along interstate or major arterial routes to provide control-of-access to the highway and access to property that would otherwise be land-locked.

5.10.2 Functional Classification and Design Standards

Each segment of a new frontage road is usually short and traffic volumes are usually low. As a result, most new frontage roads could be classified as collector roads. After the appropriate classification is determined, the corresponding Design Standards are used.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. Most existing _____ were built along interstate or major arterial routes to provide control-of-access to the highway and access to property that would otherwise beland-locked.

5.11 RIGHT-OF-WAY CONTROLS

5.11.1 General

Establishing right-of-way widths that adequately accommodate construction, utilities, drainage, and proper highway maintenance is an important part of the overall design. A wide right-of-way width permits the construction of gentle slopes, which results in greater safety for motorists and in easier and more economical maintenance of the right-of-way. The Design Standards include minimum right-of-way widths for roadways built on new location.

5.11.2 Rural

In hilly terrain, construction limits vary considerably as the roadway passes through cut and fill sections. In this situation, the required right-of-way varies, so it is impractical to use a constant right-of-way width. In flat terrain, it is usually both practical and desirable to establish a minimum right-of-way width that can be used throughout most of the project length. Required right-of-way widths should be set at even offsets from the centerline, typically multiples of 5 feet, unless some physical feature requires otherwise. Transitions in width, where required, should be as long as practical. If frequent breaks in the right-of-way line are required to increase the width by only 5 feet, for example, serious consideration should be given to increasing the minimum width by 5 feet for the entire project length. As a general rule, the required right-of-way line should be set a minimum of 10 feet beyond the proposed limits of construction (see EDSM II.1.1.1) (See Appendix A – Chapter 5).

If a future project will potentially connect to either end of the proposed project, the required right-of-way line is extended to the nearest property line beyond the extent of construction, if practical. This is done to avoid buying right-of-way from the property owner on two different occasions. In this case, the project limit will correspond to the limit of the required right-of-way.

5.11.3 Urban

In urban areas, right-of-way widths are governed primarily by economic considerations, physical obstructions, or environmental considerations. Along any route, development and terrain conditions may vary affecting the availability of right-of-way.

The minimum width of right-of-way is shown in the Design Standards. However, the right-of-way width should be sufficient to accommodate the ultimate planned roadway, including:

- median
- shoulder

- grass strip
- sidewalks
- public utility facilities
- width for necessary outer slopes, except where they are within an obtained easement

It is desirable to set right-of-way in urban areas a minimum of 6 ft to 10 ft beyond the limits of construction to easily relocate utilities.

However, property or environmental impacts discussed above may limit the amount of right-of-way that can realistically be acquired. If existing utilities are in conflict within areas of restricted right-of-way, discussions should be held at the Plan-in Hand to determine how to adequately accommodate utility relocations.

5.11.4 Special Types of Right-of-Way

1. Construction Servitude: Construction servitude is called for on the plans when an area outside the required right-of-way line is needed only during construction of the project. The most common example of this is for construction of a temporary detour road.

   A permanent feature should not be placed in a construction servitude. The decision to obtain each project. The property owner is paid a rental fee during the time the construction servitude is needed. Where applicable, the owner is also paid for damages that may be incurred during the construction process such as for removal of trees or shrubbery.

2. Drainage Servitude: Drainage servitude is required when a new lateral outfall ditch is to be constructed beyond the right-of-way or when an existing lateral outfall ditch is to be improved outside of the right-of-way. Drainage servitude is obtained when construction of these laterals is critical to proper drainage of the project. As with a c onstruction servitude, the property owner is paid for use of the drainage servitude and for damages resulting from construction. However, with drainage servitude, the Department reserves the right of permanent access to the lateral for maintenance purposes.

3. Right-of-Way Agreement (Right of Entry): In cases where yard drains are installed or where driveways are extended beyond the right-of-way line, it is not necessary to show the exact construction limits of these items on the plans. Permission to construct these items, which are for the property owner's benefit, will be obtained by the Real Estate Section. This occurs after the Road Design Section advises the Real Estate Section of the properties that

require right-of-way agreements. The Project Engineer can also obtain right-of-way agreements during construction.

The preferred method of transmitting this information to the Real Estate Section is by letter, noting the fact that right-of-way agreements are required for the completion of the construction. A simple note saying "R/W Agreement Req'd.," with an arrow drawn to the proposed yard drain or driveway extension, is shown on the plans transmitted with the letter. This note is not included on the Final Plans.

4. Control of Access: Control of Access (C of A) is purchased from property owners along major highways such as freeways. No highway access crossing the C of A is allowed, and the property owner is compensated for such restrictions. Where C of A is used along a highway, it typically extends down intersecting roadways to enhance traffic flow at the intersection. Section 3.4 of this manual and EDSM III.1.1.14 (See Appendix A – Chapter 5) contain additional discussion of C of A.

5.11.5 Accommodating Utilities

In addition to primarily serving vehicular traffic, right-of-way for streets and highways may accommodate public utility facilities in accordance with state law or municipal ordinance. Use of right-of-way by utilities should be planned to cause the least interference with traffic using the street. The border area between the roadway and the right-of-way line should be wide enough to serve several purposes. These include provision of a buffer space between pedestrians and vehicular traffic (if applicable), subsurface drainage, sidewalk space, and an area for both underground and aboveground utilities. If existing utilities are in conflict within areas of restricted right-of-way, discussions should be held at the Plan-in Hand to determine how to adequately accommodate utility relocations. Utility features, such as power poles and fire hydrants, should be located as close to the right-of-way line as feasible for safety reasons. Discussion concerning utility relocation is contained in Section 4.5.6 of this manual.

5.11.6 Expropriation

During the right-of-way acquisition process, there are occasions when the Real Estate Section has difficulty reaching an agreement with property owners on fair compensation for property and damages. During negotiations, the Designer may be asked by the Real Estate agent to review the parcel(s) to determine if impacts can be reduced or eliminated.

When negotiations with a property owner fail to obtain the property required to construct a project, the next step to acquire this property is through expropriation. EDSM II.1.1.2 (See Appendix A – Chapter 5) outlines the policy for this action.

5.11.7 Existing Right-of-Way

An effort is made to accurately determine the location of existing right-of-way and property lines before the required right-of-way is set. This is partly done to avoid acquiring unusually small parcels and/or to avoid allowing unusually small parcels to remain. As a first step in the preparation of the right-of-way maps, a base map is prepared. This map includes information obtained from the property survey, detailing the existing right-of-way and property lines throughout the project. When this base map is available, a copy should be requested for use in setting the required right-of-way.

5.11.8 Encroachments

If additional right-of-way is required, buildings that encroach on the existing right-of-way are handled the same as other buildings that fall within the required right-of-way. However, if no additional right-of-way is required, the property owner must remove all encroaching buildings, fences, etc. Road Design will send a letter to the Real Estate Section outlining possible encroachments. The Real Estate Section then advises the District Administrator of each property that indeed has encroachments within the existing right-of-way. On 100 percent state financed projects, minor encroachments that would not interfere with proposed construction and that do not violate the clear roadside concept (clear zone) are permitted to remain. However, this is only after instructions have been received for the specific project from a higher authority (see EDSM IV.1.1.9) (See Appendix A – Chapter 5).

5.11.9 Disposal of Right-of-Way

EDSM I.1.1.10 and I.1.1.19 (See Appendix A – Chapter 5) provide guidance on Department policy for disposing of right-of-way. If the Department is disposing of excess right-of-way, the Road Design Section will normally be asked to verify that the property will not be needed for future projects, or that the right-of-way disposal would not be detrimental to the operation and maintenance of the existing highway. When a roadway on new alignment renders an existing state route unneeded, the Road Design Section will request that the Office of Planning and Programming obtain the necessary agreements to dispose of the abandoned roadway. Typically, the city or parish involved will assume responsibility for the abandoned roadway.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. Establishing right-of-way widths that adequately accommodate _____, _____, _____, and _____ is an important part of the overall design.

2. In _____, it is usually both practical and desirable to establish a minimum right-of-way width that can be used throughout most of the project length.

3. In _____, right-of-way widths are governed primarily by economic considerations, physical obstructions, or environmental considerations.

4. It is desirable to set right-of-way in urban areas a minimum of ____ to _____ beyond the limits of construction to easily relocate utilities.

5. Special types of right of way are:

   a. _____

   b. _____

   c. _____

   d. _____

6. When negotiations with a property owner fail to obtain the property required to construct a project, the next step to acquire this property is through _____.

7. As a first step in the preparation of the right-of-way maps, a _____ map is prepared.

8. _____ and _____ provide guidance on Department policy for disposing of right-of-way.

5.12 ROADSIDE CONTROLS

The efficiency and safety of a highway without control of access depend greatly upon the amount and character of roadside interference. Most interference originates in vehicle movements to and from businesses, residences, or other development along the highway. Abutting property owners have rights of access but DOTD is empowered to regulate and control the location, design, and operation of access driveways and other roadside elements, such as mailboxes, in order to minimize interference to the movement of through traffic. Interference resulting from indiscriminate roadside development and uncontrolled driveway connections results in lowered capacity, increased safety hazards, and early highway obsolescence. For more information, driveways are discussed in Section 6.7, and mailboxes are discussed in EDSM I.1.1.17 (See Appendix A – Chapter 5).

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. How does roadside interference originate?

   _____

5.13 PARKING LANES

5.13.1 Policy

Generally, parking on arterial highways should be prohibited because on-street parking decreases through capacity, impedes traffic flow, and increases accident potential. At the request of the local governing authority, consideration should be given to the inclusion of parking adjacent to the roadway in special situations if the following conditions are met:

1. Parking currently exists adjacent to the roadway.
2. Adequate off-street parking facilities are unavailable or unfeasible.
3. The subsequent reduction in highway capacity will be insignificant.
4. The local governing authority has agreed to pay for the additional costs associated with the parking, such as additional right-of-way, construction costs, etc.

Final approval will be obtained from the Chief Engineer.

5.13.2 Application

When on-street parking is allowed on a roadway, parallel parking is the preferred method. Under certain circumstances, angled parking is allowed. The type of on-street parking selected should depend on the specific function and width of the street, the adjacent land use and traffic volume, as well as existing and anticipated traffic operations. Angled parking presents sight distance problems due to the varying length of vehicles, such as vans and recreational vehicles. The extra length of these vehicles may also interfere with the traveled way.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. Parking on arterial highways can be considered if:
   a. _____
   b. _____

c. _____

d. _____

2. If parking will be allowed, final approval will be obtained from the _____.

CHAPTER 8
ROADWAY PLAN PREPARATION

GENERAL 8.1

8.1.1 Engineering Graphics Standards

Graphic standards for plan development are contained in CADconform. It contains all the proper line weights and styles, text sizes and symbols that should be used when developing plans. Title sheets and all standard border sheets are available on the S: drive (in-house) and on the Altiva Software website (consultants).

8.1.2 Standard Symbols, Line Styles, and Abbreviations

Standard symbols, line styles, and abbreviations are used to insure that uniformity among plans will be maintained. In some cases, these symbols and line styles are supplemented with labels or topography notes. Other symbols and line styles may be devised as needed, provided that they are properly identified in a legend. CADconform contains approved symbols and line styles and should be used as an aid in drafting all plans sheets. All plans sheets are required to be certified as CADconform compliant. Consultants can sign into CADconform and should use it as a drafting tool. They do not have to certify.

Abbreviations are used when necessitated by lack of space or when appreciable time can be saved by their use. Accepted abbreviations are found in the Louisiana Standard Specifications for Roads and Bridges and Figures 8-01, 8-02, 8-03 and 8-04 (See Appendix C – Chapter 8). Other abbreviations should be used only when identified in a legend or when the designer has personal knowledge that the abbreviation is widely used and understood. The use of abbreviations is especially encouraged for drainage notes on plan/profile sheets and drainage summaries.

On the other hand, abbreviations are not used for pay items on any of the tables on the summary sheets. The pay items should be listed exactly as shown in the Spec Items Report or Trns·port.

8.1.3 General Drafting Procedures

1. Workmanship: Accuracy, completeness and neatness, in that order, are the most important drafting features in a set of plans. All completed drafting work should be reviewed in an effort to minimize errors and to prevent omissions.

2. Type and Size of Lettering: The size and type of lettering required for all plans sheets is contained in CADconform.

3. Sheet Border and Logo (Consultants): For projects designed by consultants, the DOTD logo in the bottom right corner of the sheet border may remain or it may be replaced with the consulting firm's logo.

8.1.4 Paper Plan Submittals

1. Full Size Submittals: Full size submittal sheets shall have an outside edge measuring 22" X 34". Provide a 0.50" margin on the top, bottom and right hand side of the sheet and a 2" margin on the left hand side of the sheet.

   The title sheet shall be provided on a mylar sheet with a minimum thickness of 3.5 mils. All other sheets shall be provided on high quality, opaque, white bond paper with a minimum 20 pound weight and a minimum 92% brightness.

2. Half Size Submittals: Half size submittal sheets shall have an outside edge measuring 11" X 17". Drawings shall be an exact 50% reduction of the full size scale drawing. Provide a 0.25" margin on the top, bottom and right hand side of the sheet and a 1" margin on the left hand side of the sheet.

3. Letter Size Submittals: Letter size submittal sheets shall have an outside edge measuring 8.5" X 11".

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. Graphic standards for plan development are contained in _____.

2. _____ are used when necessitated by lack of space or when appreciable time can be saved by their use.

3. Abbreviations are not used for _____ or any of the tables on the _____. The pay items should by listed exactly as shown in the _____ or _____.

4. What are the most important drafting features in a set of plans?

   _____

   _____

8.1.5 Organization of Plan Sheets

Plan sheets are normally included in the order shown in Sections 8.2.2 through 8.2.28 and as shown in Figure 8-05 (See Appendix C – Chapter 8). Plan sheets are numbered and arranged in a standard manner for the convenience of all users.

1. Numbering of Plan Sheets: The title sheet will be sheet number 1. For complex projects, additional sheets may be required for the index and/or for the layout map if sufficient room does not exist on the title sheet. These sheets will be numbered 1a, 1b, etc. The first typical section sheet will be sheet number 2. Additional typical sections, special pavement detail sheets, and special details included with the typical sections will be numbered 2a, 2b, etc. The summary sheets will be numbered 3, 3a, 3b, etc. The sequence of the tables will approximate the construction sequence, beginning with earthwork and ending with a general summary of bid items. The first plan/profile sheet will be sheet number 4. The remaining plan/profile sheets will be numbered in sequence from 5 on up. Immediately following the last plan/profile sheet (and drainage plan/profile for urban projects) is the reference points and bench mark elevations sheet(s), if required. Generally, the additional sheets, if required, will be numbered in the sequence presented in Section 8.2.

   Bridge plans, standard plans, and cross section sheets usually follow the order presented in Section 8.2 and are numbered with each section beginning with the next available 100 numbers. For example, if the roadway plans end with a number less than 100, the bridge plans will begin with sheet number 101, standard Plans will begin with sheet number 201. Cross section sheets usually begin with sheet number 401. If the roadway plans end in a number greater than 100, but less than 200, the bridge plans will begin with sheet number 201, etc.

2. Naming Convention of Design Files: The design files (DGNs, PDFs, etc.) need to be named in such a way that they are ordered correctly from the first sheet to the last. The files should always be named with the sheet number first. This can then be followed by an underscore and the type of sheet, if so desired. For example, the title sheet would be named 001_titlesheet.dgn or a plan/profile sheet would be named 004_planprofile.dgn.

   For plan sets that have fewer than 1000 sheets, the files shall be named using three digits. For plan sets that have over 1000 sheets, the files shall be named using four digits.

8.1.6 Survey Data and Base Map Preparation

When the project manager is notified that a project has been programmed, the design section determines the limits of the required survey data. A request detailing the required survey information is then sent to the Location and Survey Section. Care should be taken to ensure that the beginning and ending limits correspond to the direction the control section is running (west to east or south to north). Sample survey request forms are shown in Chapter 1.

If in-house survey crews are unavailable to develop the survey and/or base maps, they may be completed by consultant services. When consultant services are used to provide the roadway design and plans, they may also provide the survey and base maps.

Following survey completion, the Location and Survey Section processes the data and notifies the design section that the data has been uploaded to ProjectWise. The designer then uses this data to begin preparation of the appropriate plan and cross section sheets.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. For complex projects, additional sheets may be required for the _____ and/ or the _____ if sufficient room does not exist on the title sheet. These sheets will be numbered _____.

2. The first typical section sheet will be sheet number _____.

3. Design files need to be named in such a way that they are _____ _____ from the first sheet to the last.

4. Design files should always be named with the _____number first.

8.1.7 Plan Revisions and Change Orders

Until the Chief Engineer signs the final plans, changes can be made to the plan sheets as needed. After the design engineer (engineer of record) places his/her stamp on the sheet and signs it, changes made to the sheets must be either approved by the engineer whose stamp appears on the sheet, or if approved by an engineer other than the one who stamped the sheet originally, the second engineer must also stamp the sheet and note what changes were made.

After the Chief Engineer has signed the plans, changes made to the plans must follow one of two specific procedures, categorized as either a plan revision or a change order. The “Plan Revision” procedure is used prior to bids being taken on a project, while the “Change Order” procedure applies after bids have been taken.

1. Plan Revisions: Plan revisions are changes to the construction plans made after the Chief Engineer signs the plans, but before bids are taken.

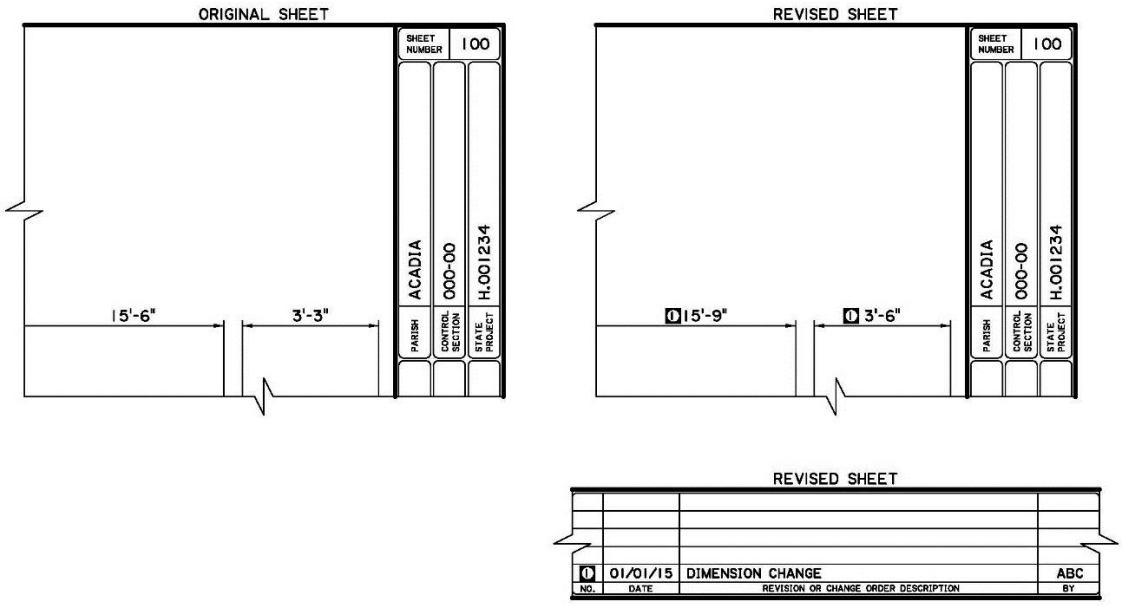
   a. Paper Plan Delivery: A written request for the affected plan sheets must be submitted to the General Files Section along with an approval of the Contracts and Specifications Engineer in order to receive the plans. This request must specify the nature of the intended revision, the anticipated amount of time required, and the name of the person in charge of the revision. In order to differentiate the revision number from other numbers on the plan sheets, a symbol ( ) has been devised with the revision number shown inside. This symbol, including the revision number, is placed on each revised plan sheet, next to the revised item and next to the revision block. A description of the revisions, initials of the person who approved the revisions, and the date the revisions were made are noted in the revision block on each of the revised sheets. All sheets involved in the revision must have the same numerical bug and date. On the title sheet, the revision symbol is placed adjacent to a line in the Schedule of Revisions block, which will contain the revised sheet numbers and the revision date.

      Once the revision has been drafted on the plans, the revised sheets are sent to the Contracts and Specifications Section for review and to update the construction proposal as necessary. The revised sheets are then returned to the person in charge of the revision who obtains approval of the revisions from the appropriate section head and from the Chief Engineer as indicated by initialing and dating the title sheet revision block. After approval is obtained, the revised sheets are returned to General Files for inclusion in the plan set.

   b. Digital Plan Delivery: The procedure for digital plan delivery is slightly different than the one stated above. A written request for the affected plan sheets is not required to be submitted to General Files, as there are not any paper plans. The plan sheets are revised in the same manner as stated above in the paper plan delivery.

      Once the affected plan sheets have been revised, they are sent to the Contracts and Specifications Section for review and to update the construction proposal as necessary via an email containing a link to the revised sheets in ProjectWise. After the person in charge of the revision has received confirmation from the Contracts and Specifications Section that they have completed their review, approval from the appropriate section head and the Chief Engineer needs to be obtained. This is also accomplished via an email containing a link to the revised sheets in ProjectWise which will be digitally signed signaling approval. After the approval is obtained, General Files is notified via email that a revision has been completed and a link is provided to the revised sheets in ProjectWise.

Example Revision



2. Change Order: Change orders are revisions made after bids are taken and usually occur while the project is under construction. Change orders are typically made at the request of the Project Engineer. The design sections may be called upon to prepare new plan sheets denoting the necessary changes.

   a. Paper Plan Delivery: Plans are checked out from General Files and the original sheets are not modified, other than stamped as "VOID."

      New sheets are created and all changes to the plans should be noted or "bugged" by placing the symbol △ and a change order letter (A, B, etc.) next to each revised item and in an available open space in the revision block or above the revision block (if space is not available). A description of the change, initials of the person who approved the change, and the date the changes were made are noted next to the change order symbol on each of the change order sheets. Each change order sheet is also stamped "Change Order and/or Special Agreement."

      Since change order sheets are new plan sheets, an alternate numbering system is used to distinguish change order sheets from original plan sheets. An "A" suffix is added to the sheet numbers for change order sheets. For example, if sheet 4 were to be revised by change order, the reproduced sheet would be numbered 4A. If it is necessary to add a completely new sheet by change order, the new sheets are inserted in the plans as "A1, A2, A3, etc." in the most appropriate location. If it becomes necessary to revise a

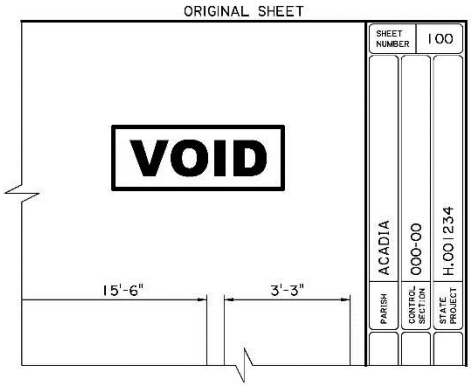
sheet added by a prior change order, then successive change order sheets are numbered as “B” sheets or “C” sheets, etc.

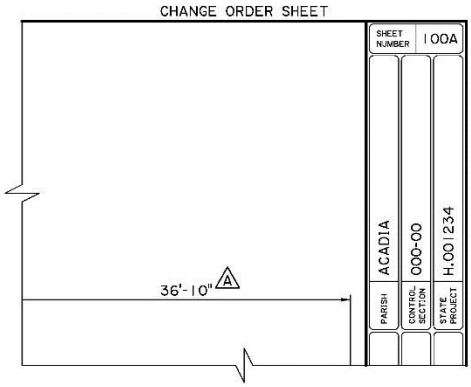
The index on the title sheet is not revised to indicate the sheets added by change order. No changes are made to the title sheet, unless the change order is to revise the title sheet specifically.

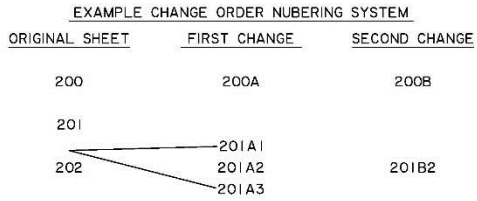
Once the change order sheets are completed, copies of the original title sheet, the new plan sheets and the voided sheets are distributed per the Plans Distribution List (Figure 1-02 - See Appendix C – Chapter 8) along with a cover letter explaining the change order. The cover letter may also contain revised quantities, if applicable. All of the original plan sheets, existing and newly created, are then transmitted to General Files for inclusion in the plan set.

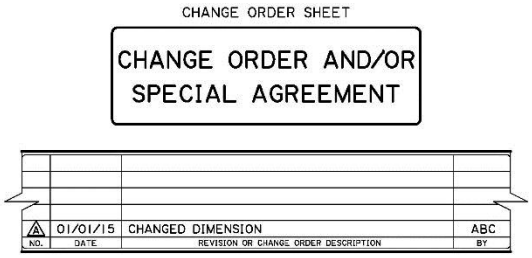
Digital Plan Delivery: A process for change orders, in which a digital plan delivery has been followed, has not yet been developed.

Example Change Order









Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. Until the _____signs the final plans, changes can be made to the plan sheets as needed.

2. _____are changes to the construction plans made after the Chief Engineer signs the plans, but before bids are taken.

3. Once a plan revision has been drafted on the plans, the revised sheets are sent to the _____ and _____ Section for review and to update the construction proposal as necessary.

4. _____ are revisions made after bids are taken and usually occur while the project is under construction.

5. True _____ False _____ For paper plan change orders, plans are checked out from General Files and the original sheets are not modified, other than stamped as "VOID."

6. New sheets are created and all changes to the plans should be _____ by placing the symbol _____ and a change order letter (A, B, etc.) next to each revised item and in an available open space in the revision block or above the revision block (if space is not available).

7. No changes are made to the _____ _____ unless the change order is to revise the _____ _____ specifically.

8.2 Format and Content of Plan Sheets

8.2.1 General

Plan preparation is divided into two major stages: preliminary and final.

- Preliminary plan preparation begins when a project is assigned and ends when the final required right-of-way is transmitted to the Location and Survey Section
- Final plan preparation begins after the transmittal of required final right-of-way to the Location and Survey Section; it ends when the Chief Engineer signs the plans.

In the Code of Federal Regulations (CFRs), the Federal Highway Administration has set forth policy and guidelines for the preparation of plans and specifications for federal aid highway projects. Instructions given therein are to be used for both federal aid and non-federal aid projects.

8.2.2 Title Sheet and Layout Map

The following information about the project and plans is shown on the title sheet. See Figures 8-06, 8-07 and 8-08 (See Appendix C – Chapter 8).

1. Layout Map: The layout map is placed in the center of the title sheet. For the typical rural project, a portion of a parish map is commonly shown. Portions of U.S.G.S quadrangle maps can also be used. For urban projects, portions of city maps are commonly shown, although other types of maps may be used. Recent aerial photographs are sometimes used with excellent results. **Avoid using color maps as they do not show up well in black and white.**

A layout map scale of 1 inch = 1 mile is common when parish map reproductions are used. For aerial photographs or other types of maps, reduction or enlargement is used (as required) to obtain one of the following scales: 1 inch = 200 feet, 300 feet, 400 feet, 500 feet,

600 feet, 1000 feet, 2000 feet, 3000 feet, or 4000 feet. The scale selected will depend primarily on the project length.

Using a border around the layout map is preferred.

a. Existing Features: The Data Collection & Management Systems Section of the Office of Multimodal Planning prepares city and parish maps, which can be used for the layout map on the title sheet. **The maps usually contain sufficient information concerning existing towns, highways, rivers, lakes, railroads, section numbers, section lines, township, range, parish lines, etc. However, the layout map should be examined to make sure that adequate geographic features are properly labeled within the limits of the map. Particular emphasis is placed on identifying all state routes within the limits of the layout map. Also, any highway additions or changes made after the map was prepared are plotted on the map.**

The map should be placed on the title sheet so that the project proceeds from left to right, generally with west being to the left of the map and south being to the bottom of the map. This would correspond to the direction that control sections run. The north arrow is shown outside the border of the layout map, preferably near the right side.

b. Proposed Construction: The beginning and end of the project are shown in bold lettering and should contain the station, control section and log mile. If the project is on a new alignment, a very heavy line is used to indicate the alignment of the proposed project. Arrows are drawn from notes placed outside the border to indicate bridge sites, equations, exceptions, railroad crossings, urban limits, etc. For a multi-lane project with a depressed median, a scale should be selected that will permit the plotting of individual roadways, including any frontage roads, grade separations, and interchanges. For clarity, a reasonable amount of exaggeration is permissible in plotting proposed construction. Appropriate project numbers and stations are shown if the beginning and ending of a project coincides with:

- a project that has been completed recently
- a project that is under construction
- or, a project that is in the design stage

2. Caption: The project caption is placed directly above the layout map and consists of (in order):

- the federal aid number (if any)
- the state project number
- the project name
- the parish(es) that the project is within

3. Vicinity Map: A state map is used as the vicinity map and it is located in the upper right corner. In addition, the appropriate parish is hatched to further identify the project vicinity.

4. Index: The index to the plan sheets is shown in the upper left corner of the title sheet, or on a separate sheet if sufficient space is not available on the title sheet. It includes a listing of the sheets, in order, by number and description. All roadway plan sheets, right-of-way maps, bridge plans, standard plans, and cross section sheets are shown in the index, along with a numerical total of all sheets. In the preliminary stage of plan preparation, the index does not list sheets not included in the preliminary plan set, such as quantity sheets, standard plans, etc. For final plan preparation, the index includes all sheets, maps, and plans required.

5. Traffic Data, Design Speed, Design Class, Access Control: This information is referred to by AASHTO as the Design Designation and is shown on the lower left corner. Required traffic data consists of the following, in the order they appear:

   - current ADT (projected ADT for the letting year)
   - future ADT (projected 20 years beyond the current ADT)
   - values of D, K, and T
   - design speed
   - posted speed
   - design classification

   The design speed and values of D, K, and T are not required for overlay projects. For other types of projects, the design speed will be shown as indicated on the pre-design conference form (See Appendix C – Chapter 8). This may or may not be the same speed indicated on the superelevation design table, since superelevation rates are sometimes based on a slightly higher speed than other design elements.
   For federal aid projects, FHWA regulations require that traffic data be updated for both the year that construction will be completed and 20 years thereafter. Therefore, new traffic data projections should be obtained and shown on the title sheet if the project schedule is changed.

6. Schedule of Revisions: The schedule of revisions block contains a complete listing of all sheets changed after the plans were signed by the Chief Engineer and prior to letting. For paper plan delivery, it is shown on the left side of the sheet beneath the index. For digital plan delivery, it is shown on the right side of the sheet beneath the vicinity map. See Section 8.1.6 for additional information concerning revisions.

7. Length and Location of Work: Data concerning the length and location of the work to be done are shown in the right, near the bottom of the sheet. Procedures for calculating the length of project are included in the Appendix. Lengths in feet are converted to miles and three decimal places are used in the “MILES” column.

8. Signatures: The signature block for the Chief Engineer is shown in the middle portion, on the right side of the sheet. In addition, the professional engineering seal and signature of the design team leader are required. These are also placed in the same area of the sheet.

9. Specification Note: A note is required referring to the specifications to be used. It should be placed in an appropriate location that does not conflict with other title sheet features.

10. Type of Construction: The type of construction is specified in the lower left corner and indicates the major construction items involved in the construction of the project. The basic idea is to provide a brief, concise description of the work involved. If a project includes one or more major bridges, such as an overpass structure or large river crossing, the type of bridge construction (as noted on the bridge general plan) should be included. Listed below are some examples:

    - Asphaltic Concrete Pavement
    - Asphaltic Surface Treatment
    - Grading, Base Course, Drainage Structures, Portland Cement Concrete Pavement, Concrete Slab Span Bridges
    - Drainage Structures, Base Widening, Asphaltic Concrete Pavement, Asphaltic Concrete Shoulders
    - In-Place Cement Stabilized Base Course, Asphaltic Concrete Pavement
    - Removing Surfacing and Stabilized Base Course, Asphaltic Concrete Pavement
    - Concrete Slab Spans and Steel Swing Span Bridge, Class II Base Course and Asphaltic Concrete

11. Miscellaneous Data: Directly beneath the layout map and to the left of the project length table, the following information is shown:

    - datum used
    - magnetic variation
    - whether bearings are true or magnetic
    - survey book numbers (if applicable)
    - scales to which plans are plotted
    - and scale of the layout map

    In the extreme upper right corner, the parish, control section and state project number are shown in the title block. On the right side of the sheet, in the title block, the individual who prepared the sheet would be shown under “DETAILED,” with the person checking the sheet shown under “CHECKED.” **Also on the right side of the sheet, the sheet number in a series of similar sheets (such as plan/profile sheets) is shown in the series number and should be labeled as 1 of 5, 2 of 5, etc.**

12. Plan-In-Hand Notes: Just prior to the plan-in-hand inspection, a temporary note is placed in a convenient location on the sheet indicating approximate earthwork quantities. Temporary notes either on the title sheet or on the first plan/profile sheet may indicate problems or questions to be resolved by the plan-in-hand party. Consultants and responsible charge must attend the field review of the Plan-in-Hand.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. Plan preparation is divided into two major stages: _____ and _____.

2. Avoid using _____ maps as they do not show up well in black and white.

3. The Data Collection & Management Systems Section of the Office of Multimodal Planning prepares city and parish maps, which can be used for the _____ ____ on the title sheet.

4. The _____ map should be examined to make sure that adequate geographic features are properly labeled within the limits of the map.

5. Particular emphasis is placed on identifying all _____ _____ within the limits of the layout map**.**

6. If the project is on a new alignment, a _____ _____ _____ is used to indicate the alignment of the proposed project.

7. The project caption is placed directly above the layout map and consists of (in order):

   - _____
   - _____
   - _____
   - _____

8. A _____ _____ is used as the vicinity map and it is located in the upper right corner.

9. For final plan preparation, the _____ includes all sheets, maps, and plans required.

10. The signature block for the Chief Engineer is shown in the middle portion, on the right side of the sheet. In addition, the professional engineering seal and signature of the _____ _____ _____ are required. These are also placed in the same area of the sheet.

8.2.3 Typical Sections

The width of the typical section, number of lanes, etc. for each project are confirmed at the pre-design conference (see Chapter 1, Section 1.3), according to the latest DOTD Design Guidelines (see Chapter 2, Section 2.2). Typical sections vary considerably depending on the type of project. Low volume, two lane projects usually require only one typical section sheet. Multi-lane projects with interchange ramps, cross roads, frontage roads, etc., will require multiple typical section sheets. Typical sections and cross sections must match.

Standard or semi-standard typical sections for various types of highways are available from the Road Design Section. Additions and modifications may be made to these drawings to fit the requirements of most projects. The existing cross section should be plotted to represent the average (or typical) existing section. Details of proposed construction should be as specific as practical. In some cases, standard details that do not apply to the project may need to be deleted.

Figures 8-09, 8-10, 8-11a, 8-11b and 8-12 (See Appendix C – Chapter 8) show some example typical section sheets. Generally, the basic elements shown on a typical section sheet are a grading section, a finished section, superelevation details, and other related details. The general purpose and basic features of the typical sections are noted in the Appendix. Some additional points of emphasis are noted below.

1. Design Data: The DOTD Pavement and Geotechnical Design Section provides the typical section design data, the pavement type, and the recommended thickness of each layer to be used in the pavement and base sections. The format for showing typical section design data on the typical section sheets are shown in Figures 8-13 and 8-14 (See Appendix C – Chapter 8).

2. Scale: Because of the wide variety of typical section classifications, it is impractical to establish uniformity of scales in plotting typical sections. It is unnecessary and usually impractical to plot all drawings on a sheet to the same scale. To present a realistic appearance, the thickness of the pavement layers should be plotted to the same scale used for horizontal line work, or as close as practical. Insets can be used to plot details of specific parts of a typical section at a larger scale, in order to clarify layer thicknesses.

3. Dimensions: All horizontal dimensions are shown in feet. Most vertical dimensions, particularly thicknesses, are shown in inches. Breaks in the proposed grading section are preferred at increments of one foot, but one-half foot breaks are also acceptable. This procedure is also used for the proposed finished section, to the extent practical. If variable dimensions refer to horizontal geometric details shown elsewhere in the plans, then the typical, maximum, and minimum values (or any combination of the three) should be appropriately shown on the Typical Section Sheet. Because of the frequency of unintentional omissions, particular emphasis is placed on showing dimensions to the following:

    - existing and/or required right-of-way lines

- area to be constructed free of obstructions (the clear zone)

4. Density Control Requirements: DOTD Standard Specifications outline density control requirements for embankment construction and for the treatment of cut areas. Notes or drawings on the typical sections should be used, as required, to supplement or supersede the Standard Specifications, but should not repeat the Standard Specifications. Density control requirements may be obtained from the Pavement and Geotechnical Design Section.

5. Limits of Erosion Control Items: The limits of erosion control items that apply to the typical roadway section, such as seeding, watering, fertilizer, mulch sod, etc., are indicated on the typical section sheet.

6. Miscellaneous: Special roadway typical sections that apply only to an isolated portion of the project (such as detour roads, transitions, or connections) may be shown either on a typical section sheet, or on the plan sheet where the section applies. Minor geometric layouts, quantity tabulations, etc. may be shown on the typical section sheet, if it is impractical to provide separate sheets for these items.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. Generally, the basic elements shown on a typical section sheet are a:

   _____

   _____

   _____

   _____

2. _____ can be used to plot details of specific parts of a typical section at a larger scale, in order to clarify layer thicknesses.

3. If variable dimensions refer to horizontal geometric details shown elsewhere in the plans, then the _____, _____, and _____ values (or any combination of the three) should be appropriately shown on the Typical Section Sheet.

4. Notes or drawings on the typical sections should be used, as required, to _____ or _____ the Standard Specifications, but should not repeat the Standard Specifications.

5. Special roadway typical sections that apply only to an isolated portion of the project (such as detour roads, transitions, or connections) may be shown either on a _____ _____ sheet or on the _____ sheet where the section applies.

8.2.4 Summary Sheets

The summary sheets are a part of final plan preparation and show the tabulations of items and quantities required to estimate and construct the project, according to the Louisiana Standard Specifications for Roads and Bridges. These tabulations are categorized by item (or related items) and are grouped in a form commonly called "tables." The tables should be arranged systematically, showing in detail how the quantities of the required pay items are determined. The scope of a particular project will dictate the items required, and thereby, determine the tables needed. Example summary sheets are shown in Figures 8-15 and 8-16 (See Appendix C – Chapter 8). All typical sections must be finalized before the items are listed and the quantities are computed in final plan preparation. Listed below are guidelines in table preparation:

1. Drafting: The outside border of each table is shown with a heavy weight line, with the inside dividing lines shown with a light weight line. Heavy or bold type lettering is normally used for table titles and light to medium weight lettering used within the table. Abbreviations should be kept to a minimum and the only abbreviations allowed are those shown in the Spec Items Report or Trns•port, such as, "Cross Drain Pipe Arch (24" Equiv. RCPA or 30" Equiv. CMPA)."

2. Types: All items that can be tabulated easily and clearly in measurable units are usually put in tables. Some typical items included in the plans that warrant tables are:

    - earthwork
    - fence
    - sidewalk
    - portland cement concrete pavement
    - erosion control
    - pavement markings
    - rice levees
    - headlands
    - base and wearing course
    - asphaltic concrete pavement
    - base widening
    - removal of pavement
    - curb, etc.

Items that are not susceptible to tabulation are estimated by other means. For example, right-of-way markers are counted from the plan/profile or plan sheets, and seeding, fertilizer, and water are computed by using the quantities-per-acre, as given in the Standard Specifications.

A summary of drainage structures table should be compiled and placed not with the summary sheets, but rather in another location in the plans (see Section 8.2.10).

3. Order and Layout: Tables are arranged on a plan sheet to allow an adequate clearance inside the border on each sheet and to allow an adequate distance (both vertically and horizontally) between the tables. As many tables as possible should be conveniently arranged on a sheet to minimize the total number of summary sheets for a particular project. On all projects requiring earthwork, an earthwork table is placed in the upper left corner of the first summary sheet.

   The Summary of Estimated Quantities table is the last table in the summary sheets. The method of generating the sheet(s) is from Trns•port once all items and notes are entered.

4. Tabulation and Computation (Excluding Summary of Estimated Quantities): Tabulations shown in tables are referenced by stations in consecutive order, starting with the beginning station of the project and proceeding to the ending station. Since equations will affect the computations, they are shown in the tables, either in the margins with arrows delineating the type and length of the equation, or in a column in the table. In tables where it is valuable to show a continuity of stations from the beginning to the end of the project (such as in earthwork, base and wearing course, asphaltic concrete, P.C.C. pavement, etc.), exceptions are shown by station, description and length. Where two or more control sections are included in the plan preparation for one project, the tables are divided to show quantities for each and are labeled accordingly.

   When computing roadway typical section quantities, such as for the base and wearing course, one table will usually be sufficient. If it is determined that more than one would be advantageous, then the station entries of each should correspond. This procedure would apply to any table(s) of a similar item that would qualify for combination or separation. This helps make the quantity tabulation understandable and affords clarity for checking.

   Tabulations and computations should be accurate, complete and understandable. Stations, descriptions, side of centerline, lengths, widths, depths or volumes per linear foot, as applicable, should be shown. If a table listing requires additional explanation, the explanation is usually placed beneath the table. Additional space should be provided between the tables and the sheet border for such notes.

The degree of accuracy in the quantity computations will be as shown in the Spec Items Report or Trns•port.

5. Summary of Estimated Quantities Table: A Summary of Estimated Quantities table is required in the plans for every project. It reflects the quantities of all work needed for the project. It represents the sum of the preceding tables, the bridge summary (if applicable), and other computations not listed in the tables. It reflects all of the quantities for the work required to estimate and construct the project. The item numbers, item descriptions, and units of measure are listed in numerical order in the table. They correspond to the exact language in the Standard Specifications.

   If an item is required that is not listed in the Standard Specifications, a special item called an NS item is used. The Contracts and Specifications Section (or the consultant when consultant services are used) writes the special provision required for the NS item. Standard wording is available for many of the NS items and should be used where applicable. The wording should be exact.

   The Summary of Estimated Quantities table has columns for the item number, description, unit and quantity. Adjacent to the quantity column is a blank column. For multiple control sections, the same format is used, but for each project a blank column follows the quantity column. A total state project column is also added, which shows the sum total of all the projects in the plans. A blank column follows the total state project column. Add a column for final quantity.

   On federal aid projects, it is sometimes necessary to denote federal participation (and non-participation) for certain items. This is usually done in additional columns that are properly labeled as above, with a total state project column included at the end of all the columns. Blank columns should be placed next to each.

   See Figure 8-17 (See Appendix C – Chapter 8) for an example Summary of Estimated Quantities table.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. The summary sheets are a part of final plan preparation and show the tabulations of items and quantities required to estimate and construct the project. These tabulations are categorized by item (or related items) and are grouped in a form commonly called

   _____.

2. All items that can be tabulated easily and clearly in measurable units are usually put in tables. Some typical items included in the plans that warrant tables are:

   _____

   _____

   _____

   _____

3. A summary of drainage structures table should be complied and placed not within the _____ _____, but rather in another location in the plans.

4. Tables are arranged on a _____ _____ to allow an adequate clearance inside the border on each sheet and to allow an adequate distance (both vertically and horizontally) between the tables.

5. Where _____ or more control sections are included in the plan preparation for one project, the tables are divided to show quantities for each and are labeled accordingly.

6. When computing roadway typical section quantities, such as for the base and wearing course, _____ table will usually be sufficient.

7. The _____ reflects all of the quantities for the work required to estimate and construct the project.

8. If an item is required that is not listed in the Standard Specifications, a special item called an _____ item is used.

9. Standard wording is available for many of the _____ items and should be used where applicable.

10. For multiple control sections, the same _____ is used, but for each project a bland column follows the quantity column.

8.2.5 Plan/Profile Sheets

1. Weight of Lines and Lettering: Contrast in line weight and lettering is especially important on plan/profile sheets. Generally, proposed construction line work and notes should appear heavier than existing topography and notes. Large lettering should be a heavier weight than

small lettering. Some specific examples of line weights and lettering to be used are as follows:

a. Light weight (weight 0): existing topography; existing ground line; tangent lines (PC to PI and PI to PT) for horizontal curves; tangent lines (PIs to points of vertical curvature) for vertical curves; dimension lines;.

b. Medium weight (weight 1): abandoned roadway centerline; horizontal curve data; proposed ditch grades; proposed drainage structure notes in profile; north arrow and scale.

c. Heavy weight (weight 3): adopted or projected centerline; baselines; identifying names of streets, rivers, lakes, etc. (upper case lettering); required right-of-way lines; equations in plan and profile; proposed grade lines; notes indicating beginning and end of project (upper case lettering); names of property owners (upper case lettering); station numbers in plan and profile; proposed drainage structures in plan and profile; and most other notes pertaining to proposed construction.

2. Format and Material: On the first plan/profile sheet, the left side of the sheet is used for the legend and general construction notes. The right half is used for plotting the beginning of the project in the plan and profile views. All other plan/profile sheets are full width sheets.

   A single plan and profile per sheet is generally used, but double plan/profile Sheets may be used for unusual projects. If a plan view is needed, but a profile is unnecessary (such as projects for overlay, guardrail, traffic markers, etc.), a double plan sheet may be used.

3. Plan Portion of the Sheet: To begin, the survey data, showing all cultural and natural details in the vicinity of the centerline, is shown on the plan portion of the sheet. The sheets should be set up so that approximately 500 ft of survey data is shown along the roadway prior to the beginning and beyond the end of construction. The topography is referenced onto the plan/profile sheets. Important topographic features, such as cattle guards, live oak trees, decorative shrubs, etc., which will be significantly affected by the proposed construction, are indicated by station location, distance from centerline, and description. Topographic notes should be placed far enough away from the centerline that they will not interfere with plotting proposed drainage structures, construction limits, required right-of-way, etc. Descriptions of topography should be as brief as possible.

   a. Plotting Centerline and Alignment: If used as the project centerline, the existing roadway centerline is shown by a heavy solid line, properly labeled. A short vertical line (tick mark) is placed on the upper side of the centerline at each station. At every fifth station, a short vertical line crossing the centerline is shown. The station number of every fifth station is shown normal to the centerline, opposite the station mark (For a scale of 1” = 20’, every station number is shown).

The centerline and other features should begin and end on even stations on each sheet. A border of at least 1 inch inside the margin on each end of the sheet will be maintained. Plotting of the centerline and all other features should begin and end abruptly at this border, with no overlap between sheets.

Small circles are drawn at PIs, PCs, and PTs of curves. Tangent lines, connecting the PI to the PC and PT, are shown by a thin, solid line. A thin solid line, normal to the centerline on the concave side, is shown at the PC and PT of each curve, with the station number shown on this line. The curve data for each curve, shown on the concave side of the curve, should be given in the following order:

- PI Station
- Delta
- Degree of Curve
- Tangent Length
- Length of Curve
- Radius

If the alignment consists of a PI and Delta only, a thin solid line normal to the centerline (line back) should be drawn at the PI, similar to that used for a PC or PT. The PI station, the deflection angle, and direction should be shown on the line. Bearings of each tangent line are shown on the centerline on each sheet and between each PT and the next PC.

b. Equations: At some locations along a project, it may be necessary or desirable to change the numbering of the stations. At such locations, notes are placed to equate the line back station (L.B.) to the line ahead station (L.A.).

Many times, an equation occurs at the PT of a curve. In such cases, both the L.B. and L.A. stations are shown on the thin solid line, normal to the centerline, at the PT. These equations should also be separately noted, as are all other equations.

A conspicuous arrow is drawn from the equation note to the point on the centerline where the equations occur. The equation note is placed beyond the limit of proposed construction, preferably above the centerline. The equation note should contain the following information, in this order:

- value of the equation preceded by a plus or minus sign
- L.B. station
- L.A. station

See Figure 8-18 for example equation notes in the plan view.

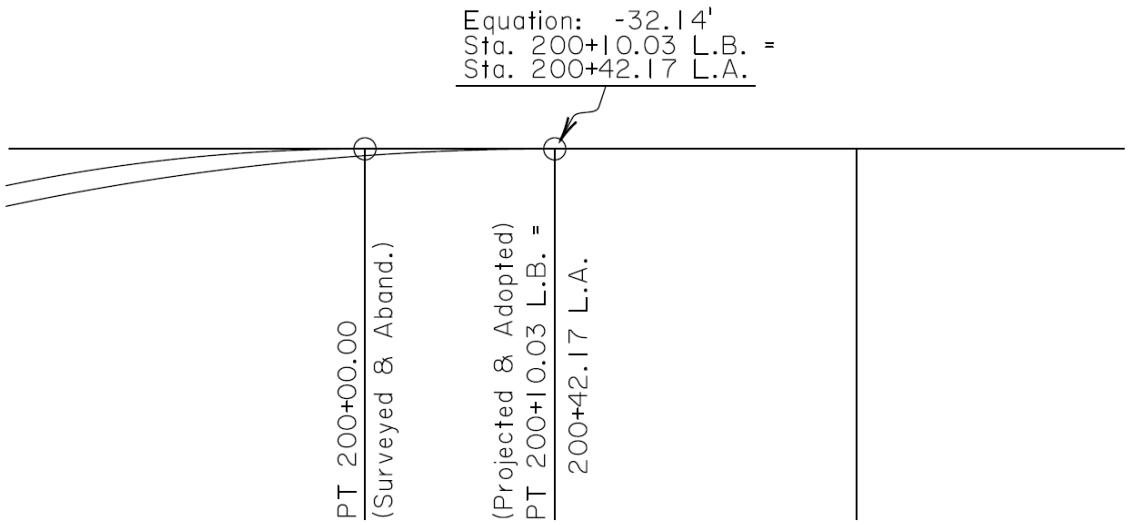


Figure 8-18: Example Equation Notes in Plan

c. Exceptions: Between the beginning and ending of construction for a site, exceptions are sometimes needed for areas where there is no construction or there is construction that is being done by someone other than the contractor. Exceptions cover short distances and are used in some of the following instances:

- railroad crossings
- intersections
- bridges, etc.

For projects that have multiple sites (each site having separate stationing), the distance between each site is not considered an exception and should not be noted as such.

d. Direction of Lettering: Lettering is arranged so that it may be read from left-to-right, or from bottom-to-top, without turning the plan sheet from its normal position.

e. North Arrow: A north arrow is placed on each plan/profile sheet preferably in the upper center to upper right portion of the plan. The scale is shown adjacent to the north arrow.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. _____ in line weight and lettering is especially important on plan/profile sheets. Generally, proposed construction line work and notes should appear _____ than existing topography and notes

2. A _____ line weight is used for abandoned roadway centerlines, horizontal curve data and the north arrow and scale.

3. On the first plan/profile sheet, the left side of the sheet is used for the _____ and _____ notes. The right half is used for _____in the plan and profile views

4. A single plan and profile per sheet is generally used, but double plan/profile sheets may be used for _____projects.

5. Survey data is shown on the _____portion of the sheets.

6. The sheets should be set up so that approximately ____ ft of survey data is shown along the roadway prior to the beginning and beyond the end of construction.

7. Topographic notes should be placed far enough away from the _____ that they will not interfere with plotting proposed drainage structures.

8. For plotting centerline and alignment, the station number of every _____station is shown normal to the centerline, opposite the station mark

9. On the plan/profile sheets, a border of at least _____ inside the margin on each end of the sheet will be maintained

10. The curve data for each curve, shown on the concave side of the curve, should be given in the following order:

    _____

    _____

    _____

    _____

    _____

    _____

11. At some locations along a project, it may be necessary or desirable to change the numbering of the stations. At such locations, notes are placed to equate the line _____ station (L.B.) to the line _____ station (L.A.).

12. The equation note should contain the following information in this order:

    _____

    _____

    _____

13. Between the beginning and ending of construction for a site, _____ are sometimes needed for areas where there is no construction or there is construction that is being done by someone other than the contractor.

14. Lettering is arranged so that it may be read from _____, or from _____, without turning the plan sheet from its normal position.

15. A north arrow is placed on each plan/profile sheet preferably in the upper _____ to upper _____ portion of the plan. The scale is shown _____ to the north arrow.

4. Profile Portion of the Sheet: The profile should be positioned after carefully considering all items that are to be plotted, including:

   - existing ground line
   - proposed grade
   - elevation of proposed drainage structures
   - elevation of proposed overpass (if any), etc.

   Projects having separate roadways, such as four lane divided roadways, may require separate profiles. For most rural projects, the profile is plotted so that the average existing ground elevation falls slightly below the center of the profile portion of the sheets. This positioning allows room for drainage structure notes above the profile. For most urban projects, the average ground elevation is plotted slightly above the center, in order to allow room for plotting the storm drain systems below the ground profile.

   a. Station Numbers and Elevations: Station numbers are shown between the bottom of the grid and the lower border. The full station number of all stations is shown. Directly above each station number, the existing ground elevation and the proposed surface elevation along the horizontal alignment are shown. At each station, the existing

ground elevation is shown on the left side of vertical line and the proposed surface elevation is shown on the right side of the vertical line.

On the left and right margins of the profile, elevations are lettered horizontally at one inch intervals as a reference for plotting. The heavy horizontal lines at one inch intervals represent elevations that are multiples of the scale used (for example, elevation 10, 20, 30, etc. for a 1" = 10' scale; elevation 4, 8, 12, etc. for a 1" = 4' scale).

b. Existing Profile Plot: All points along the centerline are plotted. This includes all breaks between stations, although the numerical value of the elevation of these breaks between stations is not shown. A thin line is drawn connecting successive points in the profile.

c. Equations: When an equation is encountered, the profile is discontinued and a "gap" is inserted between the L.B. and L.A. station. The width of the gap varies from 0 to 100ft. For a minus equation with a value of less than 100ft, the station numbers shown below the profile border may be continued with no adjustment. For all other minus equations and for all plus equations, station numbers shown below the profile border must be adjusted.

L.B. and L.A. stations are shown along the respective vertical lines plotted at these points. The value of the equation, including plus or minus sign, is shown in the space between the L.B. and L.A. station.

See Figure 8-19 for example equation notes in the profile view.

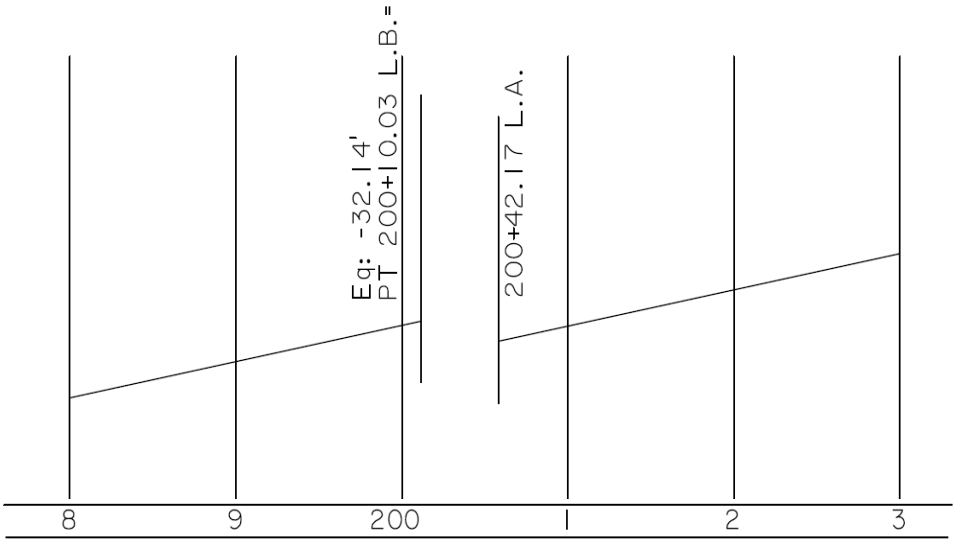


Figure 19: Example Equation Notes in Profile

d. Existing Underground Utilities: Existing underground utilities that have established elevations and that might affect the drainage design should be plotted in the profile. Included are utilities such as:

- pipelines
- gravity sanitary sewers
- fiber optic cables, etc.

5. Construction Notes and Features: During plan preparation, construction notes and features are placed on the plans. Notes concerning pay items should be written with the pay item name, and should indicate the method of payment (item number or to be included with another item). Some of the more common construction notes and features shown on the plans are discussed in the following sections.

a. Horizontal Geometry: Line work is shown for:

- roadway centerline (or baseline)
- pavement edges
- shoulders and/or curbs
- turnouts
- intersections
- driveways
- other variations from the typical section

Appropriate dimensions pertaining to centerlines and pavement widths are indicated. All frontage roads, interchange ramps, bridges, and intersecting roadways that fall within the limits of the plan sheet should be plotted with their geometric relationship to the project centerline indicated.

If separate plan/profile sheets or layouts are required for features such as diversions, ramps or frontage roads, complete horizontal geometry for these features is not shown on the mainline sheets. These features should be geometrically tied to the project centerline and to the centerline of the intersecting roadway. The significant points where grades are terminated should also be indicated in the plan.

Separate geometric layouts are usually drawn to a larger scale than the plan/profile sheet in order to show more geometric details. These layouts serve to supplement the plan/profile sheets. The sheets showing the additional geometric details are noted on the appropriate plan/profile sheets.

On plan-in-hand prints, only the basic control stations, angles, and dimensions are needed. For many projects, this data can be shown on the plan/profile sheets and the preparation of geometric layouts can be delayed until final plan preparation.

b. Drainage for Rural Projects

i. Plan: Proposed drainage structures for rural projects are represented in the plan by a standard symbol, which exaggerates the size (width) of small structures. In cases where the width of the proposed structure exceeds the width of the standard symbol, the structure is plotted to scale. Where headwalls or pipe end treatments are required, they are plotted in the plan and indicated on the drainage summary sheet. All structure lengths (estimated or computed) are plotted to scale. When plotting side drains, the location of the centerline of the proposed ditch is estimated.

In preliminary plan preparation, the disposition of existing structures is noted on the plan. Most existing drainage structures are required to be removed and a note indicating this is usually combined with a note showing the required structure.

For required cross drain structures, the following information is noted on the preliminary plan, with arrows drawn from the notes to the proposed structures:

- station
- size
  - round pipe diameter
  - arch pipe equivalent diameter
  - reinforced concrete box width, height, and number of openings
- material type
- angle of crossing, if not 90°
- any outlet erosion controls required

For side drain structures, the station, size and material type are noted in a similar manner. If a side drain structure is under an important intersecting road (NHS route, state route, etc.), it is noted with the same type of information as a cross drain structure.

Structure lengths for both cross drains and side drains are calculated for plotting purposes. During preliminary plan preparation, careful attention should be paid to ditch design. In many cases, a ditch grade can be established so that a driveway is at the high point in the ditch grade, thus eliminating the need for a side drain structure. Such driveways are referred to as dry ramps.

Notes concerning drainage area, design discharge, headwater, etc., are not shown on the plan/profile sheets for final plans when that drainage information is shown on the drainage maps. In final plan preparation, a note is placed in the profile for each drainage structure, with the following information:

- station
- disposition of existing structures
- size
- material type
- length of structure

Although seldom done, it is permissible to place drainage structure notes in the plan view for final plans using the same format as for preliminary plans provided that this can be done without congestion.

ii. Profile: In the profile, the cross drain structures are plotted, and the flow line (invert) elevations are shown. The bottom of the structure is plotted at the average elevation of the flow lines at the ends of the structure. The structures are plotted to scale vertically. Some horizontal exaggeration is permitted, but structures should be plotted to scale, horizontally, to the extent practical. Elliptical shapes should be used to plot pipes in the profile. The long axis should be placed vertically for plotting both round pipes and pipe arches. The plotting of side drain structures in the profile is unnecessary. Surveyed high water elevations are plotted and shown in the profile with the required cross drain structures. Bridges are plotted in the profile, with the design high water elevation shown.

c. Drainage for Urban Projects

i. Plan: For storm drain projects, symbols are used for catch basins, manholes, etc. that resemble their actual appearance in the plan. For storm drain pipes, a standard symbol is used, with no variation for pipe size. For multiple storm drain pipes, the symbol is repeated for each line of pipe. Cross drains are plotted the same as for rural drainage structures. A structure number is used to identify all proposed storm drain structures and structures identified “to remain,” including all pipes, catch basins, manholes, junction boxes, etc. Structures are numbered consecutively, with the structure number increasing in the direction of the flow. For preliminary and final plans, the following information is shown for each pipe:

- structure number
- station
- size
- material type

- pipe length
- flow line

For catch basins, manholes, etc. the structure number, station, standard plan, and flow lines are shown. Since these notes can become quite lengthy and repetitious, maximum use should be made of general notes, legends, and abbreviations.

ii. Profile: In the profile, the trunk line and all structures connecting directly to the trunk line are plotted. If the trunk line is carried along each side of the road, double profiles should be used to insure that all construction is shown. All structures plotted in the profile indicate the following:

- structure number
- flow line elevation
- pipe diameter
- length
- percent grade

Pipe length and grades shown should permit a mathematical check of flow lines for the trunk line. Flow lines shown in the profile are not required in the plan. Additional information shown in the plan may be repeated in the profile, but unnecessary, time consuming repetition of information should be avoided. Existing or proposed sanitary sewer lines, along with other utility lines that affect the storm drain design, should also be shown in the profile. Vertical clearances of these lines should be indicated.

An individual listing of all existing drainage structures to be removed is not required, except for reinforced concrete boxes and bridges. A note is placed on the first plan/profile sheet (or plan sheet) where drainage appears stating that all existing drainage structures are to be removed, unless otherwise indicated. This note will also summarize, in table format, the approximate quantities of existing drainage structures to be removed. Pay item 202-01-00100 Removal of Structures and Obstructions (a lump sum item) is included to pay for pipe removal, among other things.

Example Table for Pipe Removal

EXISTING PIPE REMOVAL*

PIPE DIAMETER	LIN. FT.
8"	4
12"	226
18"	1041
24"	560
30"	543
36"	276
48"	158

*FOR INFORMATIONAL PURPOSES ONLY

Existing drainage structures that flow into an open discharge channel and all existing drainage structures that are to remain should be properly noted in the profile. This is done in a manner similar to the "removal" and "remain" notes shown in the plans for a rural drainage project.

If the storm drain design cannot be adequately shown on typical plan/profile sheets, then the proposed storm drain is shown on other sheets. For a discussion of such sheets, see Section 8.2.6, "Storm Drain Plan/Profile Sheets."

d. Roadway Grades: When plotting the proposed roadway grade on the profile, only the finished grade is shown.

Roadway grades are plotted with a heavy solid line. Circles are used to indicate the point of vertical intersection (PVI), the point where the vertical curve begins (PVC), and the point where the vertical curve ends (PVT). Thin lines are used to connect the PVI with the PVC and PVT, similar to the method used for horizontal curves.

The PVI station and elevation are shown on the convex side of the vertical curve. The length of the vertical curve is shown on the concave side of the vertical curve. The center correction (C) may be shown directly below the vertical curve length, if desired.

Elevations are rounded off to two decimal places. Grade percentages may be rounded off to two decimal places, unless more than two decimals are needed to obtain a mathematical check of the elevation at a PVI.

e. Ditch Grades: Ditch grades are shown only if a ditch is required at an elevation different from the standard depth of ditch shown on the typical section sheet. Medium weight dashed lines are used to indicate ditch grades. The length of the dash is varied to contrast between ditches left, right, median (if applicable), etc. A circle is used to indicate each PI. For each PI, the station and elevation are shown. The ditch elevation

is also labeled at the beginning and ending limits of the profile. The percent of grade is labeled in the same manner as a roadway grade.

f. Limits of Construction, Right-of-Way, Servitudes, and Control of Access: The limits of construction are shown in the plan view for all projects requiring grading and earthwork. A thin, dashed line is drawn from point-to-point. Dimensions to limits of construction are not shown.

   i. For rural projects, the limits of construction is defined as the point at which the foreslope or the backslope ties in to the existing ground.

   ii. For urban projects, the limits of construction is defined as the point where the berm behind the curb or sidewalk ties in to the existing ground. **The limits of construction for an urban project can also be at the back edge of the sidewalk.**

   In certain situations, the limits of construction may not be as straight forward as stated above. If a drainage structure (such as a catch basin) is beyond the point where the toe of slope intersects the existing ground, then the limits of construction should be modified to include the drainage structure. Another situation may be a driveway that is being constructed in an area with a large elevation change. This would lead to a driveway that is significantly longer than typical. The limits of construction should be modified to include the entire driveway similar to what would be done for a turnout.

   See Figures 8-20 and 8-21 (See Appendix C – Chapter 8) for explanation of limits of construction and examples how it would typically be shown in the plan view.

   The existing right-of-way lines are shown on the plan/profile sheets and on the cross section sheets. In preliminary plan development, the existing right-of-way can usually be found from as-built plans. Later, when the property survey and base right-of-way maps are available, the existing right-of-way shown on the plans should be verified. **Since the dimensions are indicated on the right-of-way maps, the existing right-of-way line is not dimensioned on the plan/profile sheets.**

The required right-of-way lines are shown on the plan/profile sheets with dimensions at all break points and at the beginning and end of each sheet.

All right-of-way lines shown are labeled as EXISTING R/W, REQUIRED R/W, or EXISTING AND REQUIRED R/W, as appropriate.

Right-of-way monuments are shown at all breaks in the required right-of-way. In addition, monuments are shown at all PCs, PTs, points not exceeding 1000 ft apart on curves, and points not exceeding 1500 ft apart on tangents. Right-of-way monuments are not shown at the above points if it is obvious that it is physically impractical to place the monument in

such a location (for example, in a river). Right-of-way monuments are required for both rural and urban projects, except in special cases. If a clearing and grubbing project precedes a construction project, the right-of-way monuments are to be placed as part of the construction project.

Construction servitude and drainage servitude lines are shown, properly labeled, and dimensioned. Monuments are not used to indicate servitude lines.

For controlled access highways, a control of access (C of A) line is shown. If the control of access line and the required right-of-way line are coincidental, the line is labeled REQUIRED R/W & C OF A. In some cases, the face of a structure is the control of access and is so labeled. If the control of access line is not coincidental with any right-of-way line or structure face, a control of access is properly shown, labeled, and dimensioned. If the C of A line is not coincidental with any other line or structure and is a constant distance from a roadway, the dimension is more conveniently shown on the typical sections. The beginning and ending stations of the C of A lines are always noted.

g. Fences, Rice Levees, Headlands, Driveways, etc.: EDSM II.2.1.3 (See Appendix C – Chapter 8) contains information pertaining to fences. In preliminary plan preparation, the beginning and ending of each segment of linear items, such as fences, rice levees, and headlands, are indicated in the plan with an arrow. Notes are also placed that describe the item and that recommend the method of construction for the relocation. Exact station numbers are not noted at this time. After the plans are printed for final right-of-way, these notes are removed from the plan/profile sheets and the quantities are tabulated on the summary sheets.

Driveways are plotted and the required width is noted. Dry ramp locations are noted in the plans. Chapter 6, Section 6.7 contains additional information pertaining to driveways.

h. Erosion Control Items: Permanent erosion control items, such as paved ditches, riprap, side drains connecting ditches to drainage outfalls (ditch blocks), and other permanent erosion control items proposed in specific areas are shown in the plans. Temporary erosion control items are not shown on the plan, instead, tabulated in the Summary Sheets.

i. Earthwork: For preliminary plans, the earthwork data is normally totaled every 2000 ft and is shown in the lower part of the profile with the sum total shown on the title sheet (required). For final plans, earthwork data is totaled approximately every 2000 ft (corresponding to the station entries in the earthwork table) and is shown in the lower part of the profile.

j. Removal, Relocation, and Replacing/Rebuilding Items: In preliminary and final plan preparation, items that are to be replaced/rebuilt in kind, such as cattle guards, livestock

pens, ornamental brick pillars at driveway entrances, etc., are noted for removal in the plans along with the method of payment. Only front fencing that is being used as an enclosure (such as for livestock), will be replaced/rebuilt by the contractor during construction. All other items are included in the real estate agreement with the property owner in which they are compensated for the replacement/rebuilding cost. The disposition of residences, stores, sheds, barns, signs, etc. that are within or very near the required right-of-way limits is not indicated on the preliminary plans. Final disposition will be determined later, after negotiations are completed between the real estate agent and the property owner.

A building may be moved by others prior to the beginning of construction, moved by the Department's contractor or demolished by the Department's contractor. During final plan preparation, the Real Estate Section creates a list of the disposition of all buildings and structures. This list is typically provided to Road Design and should be requested if not provided. The quantities of such items are tabulated on the Summary of Estimated Quantities Sheets and properly noted on the plan/profile sheets.

k. Superelevation: Superelevation requirements are shown as a line diagram, generally in the top of the profile. Notes are placed indicating sections of normal crown, superelevation transition, and full superelevation, as required for the project.

l. Other Construction Items: Construction items noted for the plan-in-hand inspection include items such as:

- removal of pavement
- required P.C.C. pavement
- base widening
- asphaltic concrete
- removal and replacement of sidewalks, curbs, guardrails, etc.
- other items that are not shown elsewhere in the plans

Temporary notes concerning items of a general nature that require discussion by the plan-in-hand party are placed on the title sheet or the first plan/profile sheet.

During final plan preparation, specific construction items such as those listed above, are tabulated on summary sheets. They are also shown on the plan/profile sheets in the form of notes and/or symbols described in the legend. Symbols must be consistent. Items of a general nature are not noted in the final plan views but are included in the Summary of Estimated Quantities table.

6. Separate Plan and Profile: If the scope of a project requires more space than afforded by a typical plan/profile sheet, the plan view and profile can be put on separate sheets. All

information provided on typical plan/profile sheets would be shown on these separate sheets. Do not recreate notes on every page.

A wide variety of scales are used in the preparation of these separate plan sheets, depending on an individual project need. Although some projects may benefit from the use of a large scale (1" = 20' to 1" = 50'), most projects require a smaller scale (1" = 50' to 1" = 100') to provide a more valuable, comprehensive view.

7. Additional Plan/Profile Sheets: In addition to the plan/profile sheets required for the basic project, plan/profile sheets will also be required for frontage roads, relocated side roads, drainage laterals, and long turnout connections. The same procedures noted in Sections 8.2.6.1 through 8.2.6.5 would apply.

8. Sample Plan/Profile Sheets: Sample sheets are provided as follows: (See Appendix C – Chapter 8)

   a. Figure 8-22 and 8-23 shows an example plan/profile sheets for a rural, 2-lane roadway.
   b. Figure 8-24 shows an example plan/profile sheet for a rural, 2-lane roadway with a diversion.
   c. Figure 8-25 shows an example plan/profile sheet for an urban, 4-lane, divided roadway with a raised median.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. For most _____ projects, the average ground elevation is plotted slightly above the center, in order to allow room for plotting the _____ _____ _____ below the ground profile.

2. Station numbers are shown between the _____ of the grid and the _____ border. The _____ station number of all stations is shown.

3. At each station, the existing ground elevation is shown on the _____ side of vertical line and the proposed surface elevation is shown on the _____ side of the vertical line.

4. On the left and right margins of the profile, elevations are lettered _____at one inch intervals as a reference for plotting.

5. Existing underground utilities, such as pipelines, gravity sanitary sewers, and fiber optic cables that have established elevations and that might affect the drainage design should be plotted _____.

6. If separate plan/profile sheets or layouts are required for features such as diversions, ramps or frontage roads, complete horizontal geometry for these features is not shown on the _____ sheets.

7. For required cross drain structures for rural projects, the following information is noted on the preliminary plan:

   _____

   _____

   _____

   _____

   _____

8. If a side drain structure is under an important intersecting road, it is noted with the same type of information as a _____ _____ structure.

9. Notes concerning drainage area, design discharge, headwater, etc., are not shown on the _____ when that drainage information is shown on the drainage maps.

10. Structures are numbered consecutively, with the structure number _____ in the direction of the flow.

11. For catch basins, manholes, etc. the following are shown:

    _____

    _____

    _____

    _____

12. If the trunk line is carried along each side of the road, _____ should be used to insure that all construction is shown

13. A _____ is placed on the first plan/profile sheet (or plan sheet) where drainage appears stating that all existing drainage structures are to be removed, unless otherwise indicated.

14. Ditch _____ are shown only if a ditch is required at an elevation different from the standard depth of ditch shown on the typical section sheet. _____ weight dashed lines are used to indicate ditch

15. The limits of construction are shown in the _____ for all projects requiring grading and earthwork. A _____, dashed line is drawn from point-to-point. Dimensions to limits of construction are not shown.

16. For rural projects, the limits of construction is defined as the point at which the _____ or the _____ ties in to the existing ground.

17. The limits of construction for an _____ project can also be at the back edge of the sidewalk.

18. Since the dimensions are indicated on the right-of-way maps, the existing _____ line is not dimensioned on the plan/profile sheets.

19. All right-of-way lines shown are labeled as _____, _____, or _____, as appropriate.

20. In _____ and _____ plan preparation, items that are to be replaced/rebuilt in kind, such as cattle guards, livestock pens, ornamental brick pillars at driveway entrances, etc., are noted for removal in the plans along with the method of payment.

21. Construction items noted for the plan-in-hand inspection include items such as:

    _____
    _____
    _____

8.2.6 Storm Drain Plan/Profile Sheets

For urban projects, proposed storm drain notes should be shown on separate plan or plan/profile sheets. These sheets will serve either as a supplement to, or in lieu of, the proposed drainage notes on the plan/profile sheets. Usually, these layout sheets are prepared to the same scale as regular plan/profile sheets. Through judicious selection of drawing scale and maximum use of general notes, symbols, abbreviations, etc. the proposed storm drain can sometimes be shown

on the regular plan/profile sheets. Thus, the process of providing a duplicate set of plan/profile sheets can sometimes be avoided. These sheets should not appear cluttered. It is becoming more commonplace and it's hard to decipher the sheets. It should only be used for very simple work. Conditions under which storm drain plan/profile sheets are used and their characteristics are discussed below:

1. Plan/Profile: Storm drain sheets may consist of a separate set of plan/profile sheets showing the proposed storm drain in plan and profile. This type of layout is used when space is not available on the regular plan/profile sheets for plotting and identifying structures. For most projects, including those with hilly terrain and trunk lines on both the right and left side of the roadway, separate storm drain plan/profile sheets will be required to adequately show the structures.

   Figure 8-26 (See Appendix C – Chapter 8) shows an example drainage plan/profile sheet for an urban, 4-lane, divided roadway with a raised median.

2. Plan Only: For projects that consist of several roadways, such as an interchange, the overall storm drain system may be difficult to follow on plan/profile sheets if storm drain pipes cross back-and-forth from one roadway to another. For this kind of project, storm drain sheets, consisting only of a plan view, can show the relationship between storm drain structures for each roadway. If all flow lines are shown in the plan, storm drains need not to be shown in a profile.

3. Utilities: Since the disposition of existing utilities is greatly influenced by the proposed storm drain design, existing utilities are shown on the storm drain plan/profile sheets along with the proposed drainage.

4. Geometrics and Driveways: Horizontal geometric design of ramps, turnouts, intersections, driveways, curbs, etc. influences the location of storm drain inlets and should be plotted on the storm drain sheets.

8.2.7 Reference Points and Bench Mark Elevations Sheets

Survey reference points are shown along a line layout of the project centerline, typically the surveyed centerline. These reference points are shown directly adjacent to, or as near as practical to, the appropriate location along the centerline. The sketch showing the reference point need not be to an exact scale, but should be oriented to match the alignment of the centerline. The sketch should be no larger than the minimum size required for readability. Bench mark descriptions and elevations are shown along the line layout near the station where the bench mark occurs. A table showing surveyed coordinates of all reference points and bench

marks is placed on the sheet. A note should be placed on the first plan/profile sheet stating the sheet where reference points and bench marks can be found.

If possible, the line work should be of such scale to limit the layout to only one sheet. However, multiple sheets are sometimes required.

Figure 8-27 (See Appendix C – Chapter 8) shows an example Survey Reference Points and Bench Mark Elevations sheet.

8.2.8 Existing Drainage Map

A map showing existing drainage is furnished as a part of the survey information for most projects. The primary purpose of this map is to show:

- size, shape, and direction of flow of all drainage areas that will affect the proposed roadway drainage
- size of all existing drainage structures under existing roadways and railroads in the vicinity
- drainage areas for all cross-drains (indicated in bold lettering)
- other pertinent information, such as areas where flooding of the existing roadway occurs

Existing drainage information will need to be annotated and shown on the Existing Drainage Map Sheet.

Rural drainage maps are usually plotted to a scale of 1" = 400'. Urban drainage maps are usually plotted to a scale of 1" = 100'.

Figures 8-28 and 8-29 (See Appendix C – Chapter 8) show examples of existing drainage maps for rural and urban projects, respectively.

8.2.9 Design Drainage Map

1. Rural Projects: For rural projects, the design drainage map is used to show the basic drainage design data. The layout may be a composite of the existing drainage map and the U.S. Geological Survey Map (Quadrangle Map). The contours shown on the quadrangle map are useful in checking or in determining the drainage areas and watershed slopes.

   Design drainage maps are usually plotted to a scale ranging from 1" = 100' to 1" = 400'. The proposed centerline of the project is shown along with the accompanying station notations

and appropriate symbols. The beginning and ending station notes are indicated in their proper place. It is unnecessary to show curve data.

All of the information shown on the existing drainage map is indicated on the design drainage map, with the exception of descriptions and notations of existing structures. Information about the existing structures is not repeated, because of the confusion in differentiating between existing and proposed structures. The location of each cross drain is indicated by either plotting the structure or by assigning a numerical notation with an accompanying legend. Side drains are only shown for those locations designed as cross drains.

The following hydrologic information is required for each cross-drain:

- drainage area (acres)
- watershed boundaries
- flow direction
- design storm recurrence interval (years)
- design discharge (Q)
- design headwater elevation
- urbanization coefficient (if applicable)
- the method used for computing the runoff

When the Soil Conservation Service method is used, the following information is also shown:

- the soil class
- hydrologic curve number (CN)
- watershed slope (%)
- 24-hour rainfall (in inches)

When the U.S.G.S. method is used, the following information is included:

- the watershed slope (ft. per mile)
- mean annual precipitation (inches)
- hydrologic coefficient

All of the above information may be shown in tabular form using numerical references to identify individual structures.

2. Urban Projects: For urban projects, the design drainage map is used to show basic design data for the storm drain system. A scale of 1" = 100' is used for most projects. The proposed

geometric layout for the project is plotted, along with intersections and adjacent streets in the vicinity. Proposed storm drain structures are plotted and the outline of the area and the number of acres contributing to the surface drainage entering each individual storm drain structure are shown. Ridgelines between drainage areas are shown with dashed lines. The computed design discharge, including drainage entering yard drains, for each pipe or reinforced concrete box is indicated. In addition, the following design criteria for the storm drain system is shown:

- storm return frequency (typically ten years, but in some unusual situations, five years)
- rational formula (Q = CIA)
- the source of rainfall intensity data as given in the Hydraulics Manual

Design criteria for cross drain structures is shown in the same way as rural projects.

Figures 8-30 and 8-31 (See Appendix C – Chapter 8) show example design drainage maps for rural and urban projects, respectively.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. For urban projects, proposed storm drain notes should be shown on separate _____ or _____ sheets.

2. Since the disposition of existing utilities is greatly influenced by the _____ _____ _____ _____, existing utilities are shown on the storm drain plan/profile sheets along with the proposed drainage.

3. Survey reference points are shown along a line layout of the project _____, typically the _____ centerline.

4. Bench mark descriptions and elevations are shown along the _____ _____ near the station where the bench mark occurs.

5. The primary purpose of the existing drainage map is to show:

   _____

   _____

   _____

_____

6. _____ drainage maps are usually plotted to a scale of 1" = 400'. _____ drainage maps are usually plotted to a scale of 1" = 100'.

7. All of the information shown on the existing drainage map is indicated on the _____ drainage map, with the exception of descriptions and notations of existing structures.

8. Information about the _____ structures is not repeated, because of the confusion in differentiating between existing and proposed structures

9. The hydrologic information is required for each cross-drain. Name three below:

   _____

   _____

   _____

10. For urban projects, the design drainage map is used to show basic design data for the storm drain system. A scale of _____ is used for most projects.

8.2.10 Summary of Drainage Structures

A drainage summary, commonly called Summary of Drainage Structures, is a part of final plan preparation. It shows a detailed description of all required drainage structures by location, description, standard plan, allowable types, and quantities. The Preliminary Summary of Drainage Structures sheet is typically completed along with the existing and design drainage map for the 60% Preliminary Plans submittal.

After the plan-in-hand inspection, design drainage data and quantities are tabulated on work sheets or preliminary Summary of Drainage Structures sheets. Along with a current set of plans for the project, these sheets are sent to the Hydraulics Section for review. When returned to the designer, changes are back checked and differences are resolved. The checked drainage structures are then put on the Summary of Drainage Structures sheets for incorporation in the final plans.

The Summary of Drainage Structures sheets are not grouped with the Summary Sheets. However, they have a similar purpose and format. Information of a general nature found in

Section 8.2.5, “Summary Sheets,” applies to the Summary of Drainage Structures and should be referred to when they are prepared.

Rural drainage structures are listed in tabular form by stations in consecutive order. For storm drain systems, the structures are numbered and listed in consecutive order. Each structure is described by a note in the remarks column, standard plan number (if applicable), and type of structure. The type, size, and unit of measure are shown in the heading of each quantity column. Quantities are placed in the proper quantity column and each quantity column is then totaled. If two or more projects are included in one contract, a total for each project followed by a sum total for all the projects is shown.

At least one line should be skipped between individual entries. Abbreviations are used extensively in the preparation of this table. They are defined in a legend, which is usually placed on the final sheet.

An individual listing of all drainage structures to be removed is not required on the Summary of Drainage Structures. For rural projects, the removals are shown on the plan/profile sheets. For urban projects, removals are estimated and noted on the first plan/profile or plan sheet where drainage appears. Removals of reinforced concrete boxes or bridges not shown in the bridge summary of quantities are listed in the Summary of Drainage Structures, since they involve direct pay items.

When required for a project, the Hydraulics Section will furnish information concerning:

- alternate pipe types
- gages
- allowable materials
- classes
- joint types
- coatings of pipes

The structure type, class, joint type, and size(s) are shown in the column headings. The gage and alternate pipe types and sizes are shown in the description note under “remarks.” Allowable materials, coatings, and gages for side drains are not shown in the specific columns or in the remarks. They are shown as a footnote.

Figure 8-32 shows an example Summary of Drainage Structures sheet.

8.2.11 Special Details

For most projects, details will be needed to show construction items not covered by standard plans. When required, these items are delineated on special detail sheets and are usually specific to a particular project. These items include:

- special, non-standard drainage structures
- channel changes
- modifications to existing minor structures
- special guardrail installations
- retaining walls
- steps
- handrails, etc.

Occasionally, if these details are very minor, they can be more conveniently added to the plan/profile sheet in the vicinity of the items to be constructed. However, because of the extensive nature of most items needing special details, separate sheets are recommended. Special details are normally a part of final plan preparation, but they should be noted in preliminary plans for consideration and discussion at the plan-in-hand inspection.

1. Drainage Structures: Standard plans used by DOTD show all sections, details, information, and quantities necessary to construct typical drainage structures. Standard pipe structures do not need further detailing. They require only a description, size, and length. Special details are necessary when a required structure or structure extension is not detailed on a standard plan or when it is different from the standard pipe structure.

   Special details show the same type of information and design as standard plans and are similar to the standard plans in purpose and format. For further discussion and description of special details for drainage structures, see the Department's Hydraulics Manual.

2. Guardrails: Guardrail details are normally shown on standard plans. Special details are necessary when an installation is not covered by the standard plans. Special end treatments, ties to structures, height adjustments, special post spacing, etc. are some examples that might need special details to show the requirements for installation. These details are usually shown in a format similar to the standard plans.

3. Retaining Walls, Steps, and Handrails: When items such as retaining walls, steps, handrails, etc. are required for a project and no standard plan is available, special details are needed to show all of the information, design, materials, and quantities necessary for construction.

4. Others: Other items, such as concrete barrier rail, post and cable rail, lighting, channel changes, rumble strips, etc., require special details and are to be included when applicable. Any item that is inadequately detailed and/or explained in the plans, specifications, or special provisions should be considered for special detail treatment and should be shown accordingly. Formats and scales will vary depending on the individual item and need. Care should be taken to ensure that the plans reflect, in a clear and understandable way, all construction items and procedures to be used on a particular project.

8.2.12 Geometric Layout

Expanded geometric layouts of interchanges, connections, paved driveways, etc., are placed in the plans to supplement the plan/profile sheets. Layouts are usually drawn to a larger scale than the plan/profile sheets giving a clear, understandable, and more detailed picture of a particular horizontal geometric configuration.

For each detail, centerlines, station marks, and station numbers are plotted and curve data, bearings and north arrows are shown similarly to that previously described for plan/profile sheets. All roadways are labeled in bold lettering, with the same label as used for that segment of roadway on the plan/profile sheets. Curve data for all curves may be grouped together in one area of the drawing, with numbers used to identify the curves. Right-of-way and control of access is shown, where appropriate.

For urban projects that are plotted to a large scale and do not require complicated layouts, geometrics may be detailed on the plan/profile sheets. Discretion should be used, keeping in mind the space available to show geometric details and the importance of a clear and understandable picture of the required design.

1. Interchanges: For projects with complex geometry, such as an interchange, a general layout plotted to a scale of 1” = 100’ or 1” = 200’ may be used for preliminary plans. This layout should show all basic geometric design controls mentioned above, along with all information needed for clarity and understanding. The destination of each roadway should be indicated, when appropriate, at points where the roadway is terminated. Traffic data for the design year is shown for all turning movements made to and from the main roadways. Quantities are not required for preliminary plans.

For final plans, larger, more detailed layouts are developed and quantities are computed. Both the general layout and the detailed, expanded layouts are placed in the final plans. Quantities for interchanges are usually shown in tabular form in the summary sheets.

2. Connections: For preliminary plan purposes, the basic geometric design controls and the general layouts of connections are shown on the plan/profile sheets. A detailed geometric layout is usually not required for preliminary plan preparation. If full layouts are needed at this stage, preliminary drawings may be provided. Quantities are not computed in preliminary plan preparation.

   In final plan preparation, the larger, more detailed geometric layouts are detailed on the Geometric Layout and/or Detail of Connections sheets. Also included are all details, design information, north arrow, traffic data (if applicable) and quantities. A scale of 1" = 20' is most commonly used for such layouts.

3. Paved Driveways: Paved driveways are normally plotted on the plan/profile sheets and/or the storm drain sheets. Standard plans for driveways are included in all projects that require driveway construction. In most cases, the geometry is the same for all driveway locations making it unnecessary to detail each one. In unusual situations, such as where a curbed island must be designed, it may be advantageous to detail such an area on a geometric layout sheet.

8.2.13 Detail of Turnouts and Intersections

When necessary, large-scale layouts of turnouts and intersections should be prepared to show all dimensions, geometric criteria and quantities. These details are prepared to a 1" = 20' scale and are placed on the sheets in station order.

For the preliminary plan phase, the basic layout of the turnouts should be shown, along with the controlling radii and the angle of intersection with the project centerline. As noted in Section 8.2.5, this information can be shown on the plan/profile sheets if it does not congest the sheets and if the details are clear.

Figures 8-33 and 8-34 (See Appendix C – Chapter 8) show example detail sheets.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. A drainage summary, commonly called Summary of Drainage Structures, is a part of _____ plan preparation. It shows a detailed description of all required drainage structures by _____, _____, _____, _____, _____

2. Rural drainage structures are listed in _____ form by _____ in consecutive order

3. For rural projects, the drainage structures to be removed are shown on the _____ sheets. For urban projects, removals are _____ and noted on the first plan/profile or plan sheet where drainage appears.

4. The structure type, class, joint type, and size(s) are shown in the _____ headings.

5. Special details are normally a part of final plan preparation, but they should be noted in _____ plans for consideration and discussion at the plan-in-hand nspection.

6. Special details for drainage structures are necessary when a required structure or structure extension is not detailed on a _____ plan or when it is different from the standard _____ structure.

7. Guardrail details are normally shown on _____ plans. _____ are necessary when an installation is not covered by the standard plans.

8. Other items, such as concrete barrier rail, post and cable rail, lighting, channel changes, rumble strips, etc., require _____ and are to be included when applicable. Any item that is inadequately detailed and/or explained in the plans, specifications, or special provisions should be considered for _____ _____ treatment and should be shown accordingly

9. Expanded geometric layouts of interchanges, connections, paved driveways, etc., are placed in the plans to _____ the plan/profile sheets.

10. Layouts are usually drawn to a _____ scale than the plan/profile sheets giving a clear, understandable, and more detailed picture of a particular horizontal geometric configuration

11. In final plan preparation, the larger, more detailed geometric layouts are detailed on the _____ _____ and/or _____ __ _____ sheets. Also included are all details, design information, north arrow, traffic data (if applicable) and quantities. A scale of _____ is most commonly used for such layouts.

12. Paved driveways are normally plotted on the _____ sheets and/or the _____ _____ sheets.

13. Standard plans for driveways are included in _____ projects that require driveway construction. In most cases, the geometry is the same for all driveway locations making it _____ to detail each one.

14. When necessary, large-scale layouts of turnouts and intersections should be prepared to show all dimensions, geometric criteria and quantities. These details are prepared to a _____scale and are placed on the sheets in _____ order.

8.2.14 Graphical Grade Layout

For interchange ramps and other special conditions, roadway grades may be developed graphically. The corresponding elevations determined by this method are indicated on plan sheets. These elevations are shown along pavement edges, joints, and other appropriate points, as necessary, to adequately indicate the finished pavement elevations for construction. The elevations may be shown directly on the Geometric Layout Sheets, but are usually shown on separate sheets, commonly called Graphical Grade Layouts. These layout sheets consist of a general outline of the geometrics, with appropriate design information shown. Generally, the scale and other features of the graphical grade layout are as discussed in Section 8.2.15.

The interval of elevations shown depends on the scope of the geometrics and grades, but generally is 20 feet to 25 feet. For concrete paving projects that require a layout of construction joints, it is good practice to place the elevations coincidental with the joints. For standard concrete pavement no joint layout is needed.

Graphical grades may be developed in preliminary plan preparation. However, they are not normally included until final plan preparation.

Figures 8-36 and 8-37 (See Appendix C – Chapter 8) show example graphical grade layouts.

8.2.15 Joint Layout

For conventional concrete paving projects, joint layouts are needed to indicate the locations of joints at turnouts, intersections, and other irregular areas not covered by the standard plans or typical sections. A joint layout is placed in the plans to aid in the construction of a project and is shown as a "suggested" joint layout. Joints are usually labeled with abbreviations, which are explained in a legend. These abbreviations should be consistent with those shown on the standard plans or typical sections.

When it is necessary to show joints on separate sheets, joint layout sheets are developed. These sheets show the geometric outline of the concrete roadway with all pertinent design information. A scale of 1" = 20' is recommended. Joints may be appropriately shown directly on the geometric layouts, but are usually combined with the graphical grade layouts, as a supplement to the standard plans or typical sections, if they can be shown without congestion or confusion.

Joint layouts are not normally included in preliminary plans, but where required, are developed as a part of final plan preparation.

Additional discussion of the development of joint layouts is included in Chapter 6, Section 6.5.

Figure 8-38 (See Appendix C – Chapter 8) shows and example joint layout.

8.2.16 Pavement Marking Layout

In rural areas, Standard Plan PM-01 will usually suffice for pavement marking guidelines. However, when special roadway configurations are used, such as widening for left turn lanes, or for transitions in the number of lanes, layouts will be required to detail the location of pavement markings and markers.

In urban areas, layouts will normally be required when the roadway contains more than two lanes, or has widening for turn lanes. These markings and markers can sometimes be included on the Detail of Turnouts and Intersection sheets, so long as it does not congest those sheets.

EDSM VI.4.1.1 (See Appendix C – Chapter 8) contains guidance on the use of pavement markings.

Figures 8-39, 8-40, 8-41 and 8-42 (See Appendix C – Chapter 8) show example pavement marking layouts.

8.2.17 Suggested Sequence of Construction

It is necessary to schedule the construction procedure by some planned sequence in order to cause minimum delay and inconvenience to traffic. For all projects, a sequence of construction is necessary in the preliminary and final plans.

The data shown on these sheets can vary from a simple graphic alignment of the various sequences, to elaborate and complete construction details. In some cases, a typical section layout is sufficient. If it is used, a legend should be included that depicts the construction order by number. In any event, the Suggested Sequence of Construction layout should clearly indicate the exact sequence of operation, the construction to be performed, the section(s) to be used, and the traveled way to be used by all movements of traffic during each construction sequence. Arrows are used to indicate traffic flow.

The scale used on a particular Suggested Sequence of Construction layout will depend on the scope of the project and the method used to indicate the sequence. If a typical section(s) alone is used to indicate the sequence, it may be included with the typical section sheets and standard procedures for typical section drawings can be used. If the sequence is indicated using a plan layout, the scale used will normally be similar to the typical plan or plan/profile sheets. If feasible, a smaller scale can be advantageous, since an overall view is normally sufficient to adequately show the sequence. By selecting an appropriate scale, the designer typically includes the construction signing layout on these sheets.

Figures 8-43, 8-44, 8-45, 8-46 and 8-47 (See Appendix C – Chapter 8) show example sequence of construction and construction signing sheets.

8.2.18 Traffic Control Plan (Construction Signing)

As a part of final plan preparation, sheets are prepared showing the minimum construction signing required to adequately warn and direct motorists within the project. The construction signing can be shown on the Suggested Sequence of Construction sheets, although this may not always be feasible. Standard signing sheets are available for common situations, such as road closure and detour signing.

Various types of layouts can be used to obtain the required clarity. The project centerline is plotted on plan sheets at a scale ranging from 1” = 50’ to 1” = 200’. A scale should be used that

adequately and clearly conveys the construction signing. Tick marks are plotted every 100 feet along the centerline, and the number of every fifth station is shown. Each sheet may contain up to three lengths of the centerline, depending on the roadway curvature and type of construction. The beginning and ending of the project are shown with their respective stations. All public intersecting roads are plotted and are appropriately labeled. Enough detail, such as edge lines, pavement symbols, etc., should be provided to give a clear understanding of the traffic flow.

For all projects, the sheets are submitted to the Traffic Engineering Development Section for review.

EDSM III.1.1.23 (See Appendix C – Chapter 8) contains additional discussion of Traffic Control Plan requirements.

Figures 8-43, 8-44, 8-45, 8-46 and 8-47 (See Appendix C – Chapter 8) show example sequence of construction and construction signing sheets.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. For interchange ramps and other special conditions, roadway grades may be developed _____.

2. The elevations may be shown directly on the Geometric Layout Sheets, but are usually shown on separate sheets, commonly called _____ _____ _____.

3. The interval of elevations shown depends on the scope of the geometrics and grades, but generally is ____ feet to _____ feet

4. A joint layout is placed in the plans to aid in the construction of a project and is shown as a _____ joint layout

5. On a joint layout sheet, a scale of _____ is recommended.

6. Joints may be appropriately shown directly on the geometric layouts, but are usually combined with the _____ _____ layouts, as a supplement to the standard plans or typical sections, if they can be shown without congestion or confusion.

7. Joint layouts are not normally included in preliminary plans, but where required, are developed as a part of _____plan preparation.

8. In rural areas, Standard Plan _____ will usually suffice for pavement marking guidelines. However, when special roadway configurations are used, such as widening for left turn lanes, or for transitions in the number of lanes, layouts will be required to detail the location of pavement _____and _____.

9. EDSM _____ contains guidance on the use of pavement markings.

10. For all projects, a sequence of _____ is necessary in the preliminary and final plans.

11. The Suggested Sequence of Construction layout should clearly indicate the exact sequence of _____, the _____ to be performed, the _____ to be used, and the _____ way to be used by all movements of traffic during each construction sequence. _____ are used to indicate traffic flow.

12. The _____ signing can be shown on the Suggested Sequence of Construction sheets, although this may not always be feasible.

8.2.19 Subgrade Soil Survey

For most projects, a subgrade soil survey is necessary for a typical section determination. The subgrade soil survey should be requested from the District Lab Engineer during preliminary plan preparation.

In general, the information furnished consists of:

- a soil survey of the subgrade showing the classification and characteristics of different layers of soil
- pH and resistivity
- elevation of the water table
- field moisture
- tri-axial class of the worst predominant material

- the density of the in-place material along the centerline
- muck deposits
- rock formations
- quick sand, etc.

This information is typically shown in tabular format.

Consolidation tests, embankment stability analysis for high fills and organic tests in questionable areas are performed and reported. The Pavement and Geotechnical Section uses this to determine the need for lime treatment or cement stabilization.

The subgrade soil survey is performed by the District Lab Engineer and the information is usually provided to the Pavement and Geotechnical Design Section, although it may sometimes be provided to the designer. If the information is provided to the designer, then that person should provide it to the Pavement and Geotechnical Design Section. The Pavement and Geotechnical Design Section then takes the information in the subgrade soil survey and creates a sheet that can be inserted into the plans. The boring sheets must be stamped, signed, and dated by the Geotechnical Engineer. This sheet is then sent to the District Lab Engineer to be stamped and signed. The stamped and signed sheet is then provided to the designer for inclusion in the plans.

On preservation projects, the title sheet and the boring sheets are the only sheets in a set of letter size plans that are required to be signed, stamped, and dated.

If the subgrade soil survey is available, it is included in the preliminary plans. The subgrade soil survey is placed in the final plans on all applicable projects.

8.2.20 Traffic Signal Plan

As previously discussed in Chapter 6, Section 6.3, traffic signals are not installed unless all warrants are met. When new signals are required or existing signals are modified, plan sheets showing all required construction details, layouts, specifications and timing phases are included in the construction plans during the final plan phase.

8.2.21 Permanent Signs and Sign Structures

Permanent signs and sign structures are required for most projects on state highways and interstates. The District Traffic Operations Engineer (DTOE) can provide guidance about the types of signing that will be required.

Specifications pertaining to permanent signs and sign structures are included on Bridge Design Section special detail sheets. These special details include specifications for overhead traffic signs, roadside traffic signs and u-channel traffic signs.

8.2.22 Lighting Plans

Lighting is not typically required on state highways and interstates. When requested by the local public agency, and where warranted under DOTD and/or FHWA policies, roadway lighting can be a part of a project. For state highways, lighting plans are produced by DOTD Electrical Design or by a consultant. For interstates, lighting plans are produced by DOTD Electrical Design.

8.2.23 Detail of Diversion

Generally, the information shown in Section 8.2.12 concerning geometric layouts of connections applies to detours. Diversion alignments and the diversion limits of construction are shown on the plan/profile sheets. If space permits, detailed design may be shown on the plan/profile sheets. If not, a larger, more detailed geometric layout will be made on an individual basis keeping in mind that an accurate, complete, neat, and clear detail is essential for plan interpretation. Sufficient alignment data, profiles, dimensions, and typical sections are necessary to show the complete design. For most diversions, and especially those that require a sequence of construction, the larger scale of a geometric layout (1” = 20’) is recommended as it affords the necessary space to show all information, design and details.

Diversions can also be shown on a separate plant/profile sheet after the mainline plan/profile sheets.

Diversions should also be shown on the cross section sheets. Earthwork volumes are not required to be shown for the diversion. The only annotation required for diversions in the cross sections is the finished grade elevation at the centerline.

By following the general guidelines shown in Figures 4-16 through 4-18, proper diversion layouts can be developed. These layouts should include detailed geometrics and typical sections for each detour. Diversion typical section designs can be obtained from the Pavement and Geotechnical Design Section upon request.

Whenever diversions are specified on the plans, the contractor will be required to construct the detour in accordance with plan details. The contractor will also be required to maintain the diversion in a condition satisfactory to the project engineer during the time the diversion is in service. However, if the diversion is damaged or washed out due to insufficient hydraulic capacity, the contractor will restore the diversion to its original condition with the Department bearing the restoration cost.

For urban projects, temporary widening may be used for diversions. This type detour will require sufficient detail to provide for safe movement of traffic and safety for the work area.

If temporary pipes or reinforced concrete box culverts are required for the diversion, the Hydraulics Section will provide a recommended size in their hydraulic analysis.

Figure 8-35 (See Appendix C – Chapter 8)shows an example of the geometric details for a diversion.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. For most projects, a subgrade soil survey is necessary for a _____ _____ determination.

2. On preservation projects, the title sheet and the boring sheets are the only sheets in a set of letter size plans that are required to be _____, _____, and _____.

3. When new signals are required or existing signals are modified, plan sheets showing all required _____ _____, _____, _____ and _____ _____ are included in the construction plans during the final plan phase.

4. Permanent signs and sign structures are required for most projects on _____ _____and _____.

5. When requested by the local public agency, and where warranted under DOTD and/or FHWA policies, roadway _____ can be a part of a project.

6. Diversion alignments and the diversion limits of construction are shown on the _____ sheets

7. _____can also be shown on a separate plant/profile sheet after the mainline plan/profile sheets.

8. Diversions should also be shown on the cross section sheets. _____ volumes are not required to be shown for the diversion. The only annotation required for diversions in the cross sections is the _____ _____ _____ at the centerline.

9. For urban projects, temporary _____ may be used for diversions. This type _____ will require sufficient detail to provide for safe movement of traffic and safety for the work area.

8.2.24 Miscellaneous Sheets

This chapter has discussed many different types of sheets, maps, layouts, and plans that are possible in the highway plan preparation procedure and the order in which they are usually found in the plans. Other sheets may be necessary to adequately indicate the proposed construction, or the relationship of proposed construction to existing topography. These may be included in both preliminary and final plans. Sound judgment should be used in determining the need for such sheets and their proper inclusion in the plans.

8.2.25 Right-of-Way Maps

The right-of-way maps show:

- the project centerline

- the centerline alignment data
- existing right-of-way
- required right-of-way
- required construction servitude
- required drainage servitude
- limits of construction
- property owners
- property lines
- property parcels (by number)
- required area of property to be acquired
- remaining area, etc.

Further information on the preparation and requirements of right-of-way maps can be found in the Department's Location and Survey Manual. If the maps are prepared and completed by the Location and Survey Section, they are submitted (usually upon request by the Road Design Section) for incorporation into the final plans. The data shown in the right-of-way maps should be compared with the plan/profile or plan sheets to insure agreement between the sheets. As a part of final plan assembly, the appropriate sheet numbers are added to the right-of-way maps and the sheets are incorporated in the final plans.

If the right-of-way was purchased as part of a separate project, such as when purchased with a clearing and grubbing project, the construction plans should not include a copy of the right-of-way maps. Instead, a note should be placed on the first plan/profile sheet stating that the right-of-way was previously purchased. The note should include reference to the original project number and should state that copies of the maps will be made available upon request.

8.2.26 Bridge Plans

Bridge plans are furnished as a part of both preliminary and final plan preparation. In both phases, close coordination between all design parties is essential. Roadway and bridge plan development should progress at approximately the same pace, so that the plans are completed at approximately the same time.

Bridge plans are furnished for the plan-in-hand inspection and these preliminary bridge plans consist of a plan and a profile of each structure to be built. These sheets are commonly referred to as bridge general plans. Also shown on these sheets are:

- type of structure
- guardrail layout
- lengths of spans
- typical sections
- grades
- curve data
- design speed
- drainage data
- clearances
- channel relocations, etc.

For final plan preparation, the final bridge plans are incorporated in the final plans and include the general bridge plan(s) and all necessary details (spans, bents, pier footings, electrical, mechanical, etc.) required to construct a particular structure. Also included in the bridge plans is an index to the bridge plan sheets, summary of bridge quantities and general notes. For a complete description and requirements of bridge plans, see the Department's Bridge Design Manual.

When the bridge plans have been received, they should be reviewed to make sure that the road and bridge designs are compatible and that all the project identification information is correct. The title sheet index shows the bridge plans as one group labeled "Bridge Plans" properly identified by sheet numbers (see Section 8.1.4).

8.2.27 Standard Plans

The Department has available a large number of Standard Plan Sheets that cover a wide variety of standard details required in plan preparation (see also EDSM I.1.1.2) (See Appendix C – Chapter 8). Standard plans are used and incorporated in the plans to show particular details needed for the construction of a project. The original standard plan tracings are maintained at the Department and duplicate reproducible sheets are obtained for insertion into the plans.

On preservation projects (letter size plans), the standards are shown in the title sheet but are not included in the plan set.

Standard plans show details for items such as:

- drainage structures
- pavement markings
- fences
- guardrails
- right-of-way markers
- temporary erosion control
- concrete pavement
- cattle guards, etc.

A complete list should be maintained and referred to in plan preparation so as to avoid overlooking items not adequately covered in the plans. Many standard plans contain details of several items. Not all of these items may apply to a given project. However, it is usually more economical to include these sheets, with unneeded details, rather than to trace or otherwise make up a new tracing with only the applicable details.

Careful attention should be given to ensure the standard plans used are not misleading or confusing and that they adequately cover all construction procedures required. A standard plan should be clear, specific, purposeful, and appropriate for the intended use on a project. If a standard plan is modified in any way, the standard plan number, the standard plan designation and the Chief Engineer's signature are removed. The sheet is then included as a special detail with the stamp and signature of the engineer that oversaw the modifications.

Standard plans are not normally included in the preparation of preliminary plans. In final plan preparation, all standard plans needed to supplement the plans are listed in the index of the title sheet. The appropriate date to show with the standard plan on the title sheet will be the date the Chief Engineer approved the standard plan, or the latest revision date shown in the revision block of the standard plan. The most recent date is used.

The following sections within the Department have responsibility for maintaining certain standard plans:

1. Road Design: Driveways, fencing, cattle guards, concrete paving details and mailbox installations.

2. Bridge Design: Span details, approach slabs, bent details, guardrail and retaining walls.

3. Hydraulics: Catch basins, manholes, box culverts, paved ditches, and erosion control.

4. Location and Survey: Right-of-way monuments and witness posts.

5. Traffic Engineering Development: Pavement markings, delineators, and object markers.

8.2.28 Cross Section Sheets

Cross section sheets should contain all of the following information:

1. Profile of the ground line.

2. Proposed cross section.

3. Station location with offsets from the centerline.

4. Elevation of the existing surface at the centerline.

5. Elevation and offset of points across the cross section such as the centerline, lane lines, edge of shoulder, toe of slope, ditch bottom, etc.

6. Cross drain pipes and reinforced concrete box culverts (if applicable).

7. Volumes (in cubic yards) of excavation and embankment are to be shown in the upper right corner for each cross section.

8. Existing right-of-way, required right-of-way, required construction servitude and required drainage servitude limits are to be shown as vertical lines, of the appropriate line style and weight, and labeled appropriately.

9. Diversions will be shown on the cross sections along with the finished grade elevation of the diversion at the centerline. Cross sections are shown without the excavation and embankment volumes of the diversion.

If the required right-of-way falls beyond the limits of the sheet, this should be noted. Earthwork volumes and right-of-way lines are optional for preliminary plans.

Typical sections, plan/profile, and cross sections should match.

The limits of construction should not fall outside of the right-of-way.

In order to show as much detail as possible, a 1”=5’ scale is preferred. When required to show a wider section, such as for a four-lane divided roadway, a 1”=10’ scale may be more appropriate. Whichever scale is selected, the same scale is used for both horizontal and vertical plotting.

While generally preferred, it is not necessary to plot the cross section so that the centerline of the project falls in the center of the sheet. On some projects, such as when adding two-lanes to the existing two-lanes, it is more appropriate to plot the sections with the project centerline shifted off-center of the sheet. Because of the width necessary on some projects, it may be necessary to split the cross section plotting the left side of the centerline below the right side.

Typically, an elevation range is selected that allows for three cross sections to be shown per sheet. However, in hilly areas or areas with a lot of fill, the elevation range of the individual cross sections may be too great to allow three. In this instance, fewer than three may be shown. If the elevation range is small enough, more than three cross sections may be shown per sheet (with the maximum being five) as long as all the required information can fit and is legible.

Figures 8-48 and 8-49 show examples of rural and urban cross section sheets, respectively.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. Other sheets may be necessary in the plans to adequately indicate the proposed construction, or the relationship of proposed construction to existing _____.

2. The right-of-way maps show:

   _____

   _____

   _____

3. Further information on the preparation and requirements of right-of-way maps can be found in the Department’s _____.

4. The data shown in the right-of-way maps should be compared with the _____ or _____sheets to insure agreement between the sheets.

5. When the bridge plans have been received, they should be _____ to make sure that the road and bridge designs are _____ and that all the project identification information is _____.

6. _____ plans are used and incorporated in the plans to show particular details needed for the construction of a project. The original tracings are maintained at the Department and duplicate reproducible sheets are obtained for _____ into the plans.

7. A standard plan should be _____, _____, _____, and _____ for the intended use on a project.

8. If a standard plan is modified in any way, the standard plan _____, the standard plan _____ and the _____ signature are removed. The sheet is then included as a _____ _____ with the stamp and signature of the engineer that oversaw the modifications.

9. The appropriate date to show with the standard plan on the title sheet will be the date the Chief Engineer _____ the standard plan, or the latest _____ date shown in the revision block of the standard plan. The most _____ date is used.

10. _____ _____ sheets should contain the station location with offsets from the centerline.

11. The cross section sheets should contain _____ (in cubic yards) of excavation and embankment to be shown in the upper right corner for each cross section.

12. Existing right-of-way, required right-of-way, required construction servitude and required drainage servitude limits are to be shown as _____ lines, of the appropriate line style and weight, and labeled appropriately.

13. In order to show as much detail as possible, a _____ scale is preferred. When required to show a wider section, such as for a four-lane divided roadway, a _____ scale may be more appropriate. Whichever scale is selected, the _____ scale is used for both horizontal and vertical plotting.

14. Typically, an elevation range is selected that allows for _____ cross sections to be shown per sheet. If the elevation range is small enough, a maximum of _____ may be shown per sheet.

8.3 Engineers Estimate

The engineer's estimate is a critical aspect at each stage of project development. The following describes the estimate requirements at each stage:

1. Preliminary: A preliminary cost estimate is developed using conceptual information. Many times, historical data on the cost-per-mile of similar type projects is used to determine the preliminary estimate. This is done by the Transportation Planning Section during the Stage 0 process.

2. Plan-In-Hand: At this point in plan development, the project scope is well defined and quantities for major construction items can be determined. These major items normally account for approximately 80 percent of the project cost. An additional factor should be added for all the remaining items for which quantities are unavailable. If the project has some very unusual items that could significantly impact the project cost, an estimate for these items should be developed to provide a more accurate project estimate.

   A complete list of the proposed items should be included in the plan-in-hand transmittal. Items will be discussed at the plan-in-hand inspection to ensure that all items required for construction are included in the contract.

3. Final: Once final plan quantities have been determined, average unit prices developed by the Department can be used in completing the final cost estimate. These unit price figures must be adjusted to consider the quantity of the item, the project location within the state, the availability of the items and the location of material sources.

   The final estimate is included with the final plans for the Chief Engineer's approval. The estimate must be reviewed periodically to ensure that the unit prices are current and should be revised if needed. After the Chief Engineer approves the estimate, revisions must be processed using a procedure similar to that outlined for plan revisions in Section 8.1.6.

It is important to keep cost estimates up-to-date as any changes can have an impact on the delivery and letting dates. Anytime the cost estimate changes (no matter how significant), the Transportation Planning Section needs to be notified. A good rule of thumb to follow is to review and update cost estimates at least every six months.

8.4 Specifications

To insure that the final product produced by the contractor is acceptable for the purpose intended, the Department develops specifications for all construction items and procedures. These specifications detail:

- acceptable materials
- strength of materials
- construction procedures
- contractor responsibilities to the Department and to the public
- how to measure construction items
- how the contractor is to be paid

In case of discrepancy between the plans and specifications, the following governing order has been established:

1. Calculated dimensions will govern over scaled dimensions.

2. Plans will govern over standard specifications or supplemental specifications.

3. Supplemental specifications will govern over standard specifications.

4. Special provisions will govern over standard specifications, supplemental specifications and plans.

Specifications are found in the following:

1. Standard Specifications: A book of specifications for general application and repetitive use. It is a compilation of provisions and requirements for the performance of prescribed work.

2. Supplemental Specifications: Additions and revisions to the Standard Specifications.

3. Special Provisions: Additions and revisions to the standard and supplemental specifications covering conditions applicable to the project.

4. Project Specifications: All Standard Specifications, Supplemental Specifications, Special Provisions and other provisions applicable to the project.

Complete the following questions and check your answers in the Answer Key in the back of the manual.

1. The engineer's _____ is a critical aspect at each stage of project development.

2. If the project has some very _____ items that could significantly impact the project cost, an estimate for these items should be developed to provide a more accurate project estimate.

3. A complete list of the proposed items should be included in the _____ transmittal. Items will be discussed at the _____ inspection to ensure that all items required for construction are included in the contract.

4. Once final plan quantities have been determined, _____ _____ _____ developed by the Department can be used in completing the final cost estimate. These _____ _____ _____ must be adjusted to consider the quantity of the item, the project location within the state, the availability of the items and the location of material sources.

5 The final estimate is included with the final plans for the _____ approval.

6. It is important to keep cost estimates up-to-date as any changes can have an impact on the _____ and _____ dates. A good rule of thumb to follow is to review and update cost estimates at least every _____ months.

7. To insure that the final product produced by the contractor is acceptable for the purpose intended, the Department develops specifications for all construction items and procedures. Name three things these specifications detail:

   _____

   _____

   _____

8. In case of discrepancy between the plans and specifications, the following governing order has been established:

   a. _____ dimensions will govern over _____ dimensions.

   b. _____ will govern over _____ specifications or _____ specifications.

   c. _____specifications will govern over_____ specifications.

d. _____ _____ will govern over standard specifications, supplemental specifications and plans.

9. Match the definition to the term:

____ Standard Specifications

___ Supplemental Specifications:

___ Special Provisions:

___ Project Specifications

A. Additions and revisions to the standard and supplemental specifications covering conditions applicable to the project.

B. Additions and revisions to the Standard Specifications.

C. All Standard Specifications, Supplemental Specifications, Special Provisions and other provisions applicable to the project.

D. A book of specifications for general application and repetitive use. It is a compilation of provisions and requirements for the performance of prescribed work

Figures can be accessed by clicking the link below to the Road Design Manual.

http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/Road_Design/Pages/Road-Design-Manual.aspx

Figure	Title
CHAPTER 5 – CROSS SECTION ELEMENTS	
5-08	Curb – Curb and Gutter Details
5-09	Detail of Curbed Driveway
5-10	Standard Driveways Adjacent to Mountable Curb
5-11	Monolithic Construction of Island Nose
5-12	Curbed Islands with Shoulders
5-13	Curbed Islands – No Shoulder
5-16	Paved Embankment Widening Detail – No Pipe
5-17	Paved Embankment Widening Detail – With Pipe
5-18	Depressed Median on Rural Roadways
5-19	Flush Median Used as a Continuous 14’ Left Turn Lane
5-20	Raised, Grassed Median (Urban)

EDSMs can be accessed by clicking the link below to the EDSM Manual.
http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Engineering/EDSM/Pages/default.aspx

EDSMs

EDSM No. II.2.1.11
EDSM No. II.2.1.12
EDSM No. II.2.1.8
EDSM No. II.2.1.10
EDSM No. II.3.1.4
EDSM No. II.1.1.1
EDSM No. II.1.1.14
EDSM No. II.1.1.2
EDSM No. IV.1.1.9
EDSM No. I.1.1.10

EDSM No. I.1.1.19
EDSM No. I..1.17

Figure	Title

CHAPTER 8 – ROADWAY PLAN PREPARATION

8-45 a, b, c Sequence of Construction Phase III
8-46 a, b, c Sequence of Construction Phase IV
8-47 Detour Signing and Map
8-48 Rural Cross Sections
8-49 Urban Cross Setions

EDSMs

EDSM No. VI.4.1.1
EDSM No. III.1.1.23
EDSM No. I.1.1.2

Introduction

1. American Association of State Highway and Transportation Officials
2. *Roadway Design Procedures and Details Manual*
3. EDSM
4. Louisiana Standard Specifications for Roads and Bridges

Chapter 5 – Cross Section Elements

5.1-5.13

1. Pre-Design Conference
2. EDSM II.2.1.11 and II.2.1.12
3. Pavement and Geotechnical Section
4. The Plan-in-Hand inspection
5. 2 ft., 2 ft.

5.2 – 5.2.4

1. Design Standards
2. design exception
3. 2500, 12, 3 ft.
4. 2.5
5. shoulder rumble strips
6. clear roadside concept
7. breakaway posts
8. 6:1

5.3

1. Two-way tangent Crown

2. 5 percent (0.05 ft/ft)

5.4.1-5.4.4

1 23 ft.

2. vertical

3. Airway-Highway clearance Form

5.5-5.5.6

1. d.

2. EDSM II.2.1.7

3. guardrail

4. mountable or vertical

5. asphaltic curbs

6. asphaltic concrete pavement

7. d.

8. curbed islands

5.6.1-5.6.5

1. EDSM II.2.1.10

2. barrier curb

3. 6 ft.

4. sidewalks and curbs

5. EDSM II.3.1.4

5.7.1 -5.7.3

1. plans

5.8

1. guardrail

2. Bridge Design Manual, guardrail standard plans

5.9.1-5.9.3

1. depressed or raised
2. flush
3. reduce travel time

   improve capacity

   reduce accident frequency (particularly rear-end accidents)

   facilitate maintenance of through traffic during construction or lane-closure of a through lane

4. regulate left turn movements

   provide positive separation of opposing lanes of traffic

   provide a more esthetically pleasing roadway.

5.10.1-5.10.2

1. frontage roads

5.11.1 – 5.11.9

1. construction, utilities, drainage, proper highway maintenance

2. flat terrain

3. urban areas

4. 6 ft., 10 ft.

5. construction servitude

   drainage servitude

   right-of-way agreement (right of entry)

   control of access

6. expropriation

7. base

8. EDSM I.1.1.10 and I.1.1.19

5.12

1. vehicle movements to and from businesses, residences, or other development along the highway

5.13.1-5.13.2

1. a. Parking currently exists adjacent to the roadway\\
.

   b. Adequate off-street parking facilities are unavailable or unfeasible. .

   c. The subsequent reduction in highway capacity will be insignificant.

   d. The local governing authority has agreed to pay for the additional costs associated with the parking, such as additional right-of-way, construction costs, etc.

2. Chief Engineer

Chapter 8 – Roadway Plan Preparation

8.1 – 8.1.4

1. CADconform
2. Abbreviations
3. pay items, summary sheets, Spec Items Report or Trns·port.
4. accuracy, completeness, and neatness

8.1.5 – 8.1.6

1. index, layout map, 1a, 1b, etc
2. 2
3. ordered correctly
4. sheet

8.1.7

1. Chief Engineer
2. Plan revisions
3. Contracts and Specifications
4. Change Orders
5. True
6. noted or bugged, △
7. title sheet, title sheet

8.2-8.2.2

1. preliminary, final

2. color

3. layout map

4. layout map

5. state routes

6. very heavy line

7. Federal aid number
   State project number
   Project name
   Parish(es) that the project is within

8. state map

9. index

10. design team leader

8.2.3

1. grading section
   finished section
   Superelevation details
   other related details

2. Insets

3. typical, maximum, and minimum

4. supplement, supersede

5. typical section, plan sheet

8.2.4

1. “tables”

2.
   - earthwork
   - fence
   - sidewalk
   - portland cement concrete pavement
   - erosion control
   - pavement markings
   - rice levees
   - headlands
   - base and wearing course
   - asphaltic concrete pavement
   - base widening
   - removal of pavement
   - curb, etc.

3. summary sheets

4. plan sheet

5. two

6. one

7. Summary of Estimated Quantities table

8. NS

9. NS

10. format

8.2.5

1. contrast, heavier

2. medium weight (weight 1)

3. legend, general construction, plotting the beginning of the project

4. unusual

5. plan

6. 500

7. centerline

8. fifth

9. one

10.
    - PI Station
    - Delta
    - Degree of Curve
    - Tangent Length
    - Length of Curve
    - Radius

11. line back, line ahead

12.
- Value of the equation preceded by a plus or minus sign
- L.B. station
- L.A. station

13. exceptions

14. left-to-right, bottom –to-top

15. center, right, adjacent

8.2.5 continued

1. urban, storm drain systems

2. bottom, lower, full

3. left, right

4. horizontally

5. in the profile

6. mainline

7.
    - station
    - size
        - round pipe diameter
        - arch pipe equivalent diameter
        - reinforced concrete box width, height, and number of openings
    - material type
    - angle of crossing, if not 90°
    - any outlet erosion controls required

8. cross drain

9. plan/profile sheets for final plans

10. increasing

11. structure number, station, standard plan, flow lines

12. double profiles

13. note

14. grades, medium

15. plan view, thin

16. foreslope, backslope

17. urban

18. right-of-way

19. EXISTING R/W, REQUIRED R/W, ENISTING AND REQUIRED R/W

20. preliminary, final

21.
    - removal of pavement
    - required P.C.C. pavement

- base widening
- asphaltic concrete
- removal and replacement of sidewalks, curbs, guardrails, etc.
- other items that are not shown elsewhere in the plans

8.2.6 – 8.2.9

1. plan, plan profile

2. proposed storm drain design

3. centerline, surveyed

4. line layout

5.
    - size, shape, and direction of flow of all drainage areas that will affect the proposed roadway drainage
    - size of all existing drainage structures under existing roadways and railroads in the vicinity
    - drainage areas for all cross-drains (indicated in bold lettering)
    - other pertinent information, such as areas where flooding of the existing roadway occurs

6. rural, urban

7. design

8. existing

9.
    - drainage area (acres)
    - watershed boundaries
    - flow direction
    - design storm recurrence interval (years)
    - design discharge (Q)
    - design headwater elevation
    - urbanization coefficient (if applicable)
    - the method used for computing the runoff

10. 1” = 100’

8.2.10 – 8.2.13

1. final, location, description, standard plan, allowable types, quantities
2. tabular, stations
3. plan/profile, estimated
4. column
5. preliminary plans
6. standard plan, pipe
7. standard, special details
8. special details, special detail
9. supplement
10. larger
11. Geometrid Layout, Detail of Connections, 1" – 20 '
12. plan/profile, storm drain
13. all, unnecessary
14. 1" = 20', station

8.2.14 – 8.2.18

1. graphically
2. Graphical Grade Layouts
3. 20, 25
4. "suggested"
5. 1" = 20'
6. graphical grade

7. final

8. PM-01, markings, markers

9. VI.4.1.1

10. construction

11. operation, construction, section(s) traveled

12. construction

8.2.19 – 8.2.23

1. typical section

2. signed, stamped, dated

3. construction details, layouts, specifications, timing planses

4. state highways, interstates

5. lighting

6. plan/profile

7. diversions

8. Earthwork, finished grade elevation

9. widening, detour

8.2.24 – 8.2.28

1. topography

2.
   - the project centerline
   - the centerline alignment data
   - existing right-of-way
   - required right-of-way
   - required construction servitude
   - required drainage servitude

- limits of construction
- property owners
- property lines
- property parcels (by number)
- required area of property to be acquired
- remaining area, etc.

3. Location and Survey Manual

4. plan/profile, plan

5. reviewed, compatible, correct

6. Standard

7. clear, specific, purposeful, appropriate

8. number, designation, Chief Engineer's

9. approved, revision, recent

10. Cross Section

11. volumes

12. vertical

13. 1" = 5', 1" = 10', same

14. three

8.3 – 8.4

1. estimate

2. unusual

3. plan-in-hand, plan-in-hand

4. average unit prices, unit price figures

5. Chief Engineer's

6. delivery, letting, six

7.

- acceptable materials
- strength of materials
- construction procedures
- contractor responsibilities to the Department and to the public
- how to measure construction items

8.

5. Calculated dimensions will govern over scaled dimensions.

6. Plans will govern over standard specifications or supplemental specifications.

7. Supplemental specifications will govern over standard specifications.

8. Special provisions will govern over standard specifications, supplemental specifications and plans.

9. D, B, A, C